Modelling scenarios for NHS Health Check using Microsimulation

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Introduction

• Overview and aim of this presentation:
  • Why modelling?
  • Advantages of microsimulation
  • Example: Cholesterol and Statins
Why modelling?

- Including knowledge available since 2008
- Focussing on eligibility
- Refined methodological approach
Modelling approach: Microsimulation

- Microsimulation:
  - An individual-level simulation over time

- Main advantages:
  - Population to individual level
  - Capturing individuals’ variability
Example: Cholesterol trajectory

**Individual from HSE:**
Male, age 33,
Eth=1, qimd=4,
chol=5.8, BMI=28.5

**Match to individual from longitudinal dataset (ELSA):**
Based on age, cholesterol, BMI

Rematch to new individual from ELSA
Example: Cholesterol trajectory

Health Check, Statin prescription

Rematch to new individual from ELSA
Model pathway: Cholesterol and Statins

Population

Eligible (83% of age 40-74) \[1\]

HC uptake (9.6% of eligible pop./yr) \[2\]

QRisk assessment

QRisk <20: 1.5% additional Statin prescript. \[2\]

QRisk >20: 2.5% additional Statin prescript. \[2\]

50% treatment adherence \[3\]

Mean total Cholesterol change: -1.22 \[4\]

Sources: \[1\] DH website (2014/15), \[2\] Robson et al. (2014), \[3\] Lemstra et al. (2012), \[4\] Cholesterol treatment trialists (2015)
Comparing HC vs. no HC for statin takers

![Graph showing change in total cholesterol level over time after statins uptake. The graph compares the mean cholesterol change with HC (solid line) and the mean cholesterol change in controls (dashed line). The y-axis represents the change in cholesterol level, and the x-axis represents time after statins uptake in years.](image-url)
Comparing HC vs. no HC for statin takers
Comparing HC vs. no HC for statin takers
Summary

• We built a microsimulation model around part of Health Check programme
• Comparison between simulations with vs. without Health Check possible
• Model focus on simulating what-if scenarios around eligibility and uptake of Health Check
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Model characteristics

• This model is **based on cross-sectional and longitudinal datasets** which are combined for the simulation over time (individual risk factor trajectories)
• Model assumes that **longitudinal data capture current treatment**
• Model focus on **CVD, Dementia and Lung cancer**
• Risk factors: **BP, BMI, Cholesterol, Smoking, HbA1c**
Diseases

- **CVD**: probability of event from *Qrisk*:
  - 10-year risk annualised using incidence data, based upon age and sex
- **Dementia**: probability of event from:
  - Age <60: CAIDE risk score
  - Age >60: following life table trend
- **Lung Cancer**: probability of event from life table ata, based on age/sex, data from cancer registry
- **Case fatality / mortality** data: ONS death statistics
Diseases and Treatment overview
Objective: Finding individuals in ELSA with corresponding characteristics, applying their change in risk factor over next 4 years

Some data from ELSA: BMI measurements and follow-ups for a random subset of individuals.
Modelling risk factor trajectories

Sampling process example: Cholesterol trajectory

Grey: potential delta chol, based upon sex/chol categories

Red (faint): restricted pool of delta chol

Red (thick): sampled delta chols from restricted pool
Core model – Modelling trajectories

Covariates in longitudinal data that are assumed to predict each CVD risk factor
Health check Uptake - Data

- 20% of eligible population is offered a HC each year.
- We assume that 9.6% of total eligible population receive a HC each year
- 48% of eligible population receives HC each year.
- Based on 2014/15 DH figures of 19.7% of eligible population offered HC in 2014/15, and 48.8% of these taking up.
- Uptake among non-eligible individuals based upon chronic condition estimated at 5% per year.
Treatment – Data on who gets treated

- Smoking: 6.8% of smokers are referred to smoking cessation
- Obesity: 38.7% of people with BMI ≥ 30 are referred to diet and exercise
- Statins:
  - Qrisk < 20: 2.05% additional prescription
  - Qrisk > 20: 14.2% additional prescriptions
- Anti-HT:
  - Qrisk < 20: 1.5% additional prescriptions
  - Qrisk > 20: 2.5% additional prescriptions
Treatment – Data on effect

- Smoking cessations: 14.6% of those referred have quit after 1 year
- Weight management:
  - average change -2.0 BMI in completers -0.7 in non-completers,
  - Adherence 58% (completers)
- Statins:
  - Mean change of -1.22 in total cholesterol
  - Adherence 50%
- Anti-HT:
  - Age-dependent changes of SBP and DBP, between -3.1 and -9.0 for SBP
  - Adherence 55%
Treatment – Example: Smoking Cessation

- Trajectories from ELSA suggested higher quit rates and lower relapse rates after quitting than observed in studies.
- For smoking, assuming people are ex-smokers if there are two consecutive records of not smoking.
- Probabilistically, we reduce the quit rate from 6.5% in ELSA to 5%.
- Probabilistically, we increase the relapse rate to 37% over 10 years.