INSTITUTO SUPERIOR TÉCNICO
Universidade Técnica de Lisboa

11ª Conferência Nacional em Economia da Saúde

# ESTIMATING THE IMPACTS ON HEALTH GAINS AND COSTS FROM IMPROVING DIAGNOSIS AND TREATMENT OF HEART FAILURE IN ENGLAND

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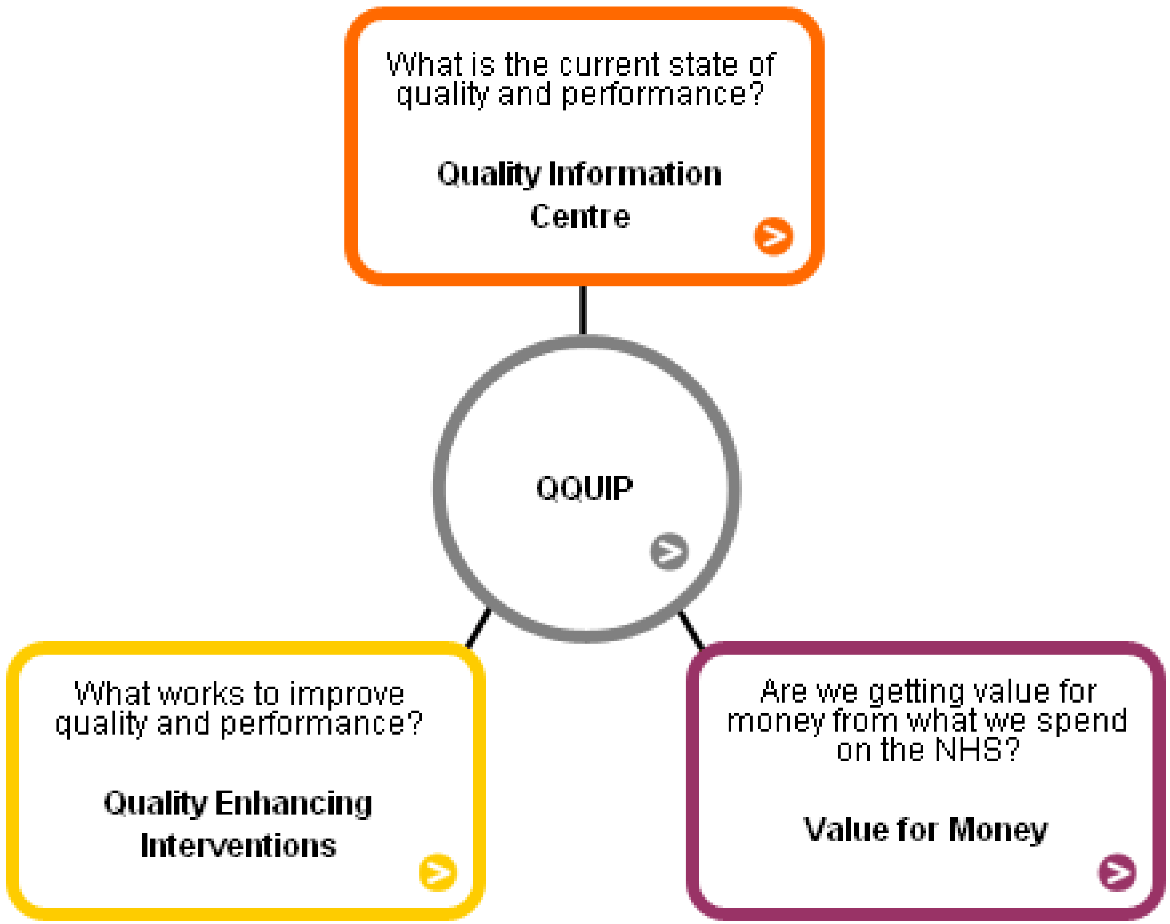
# SUMMARY

- BACKGROUND INFORMATION
- METHODOLOGICAL APPROACH
- RESULTS
- DISCUSSION
- CONCLUDING REMARKS

# What works to improve health gains and productivity in the NHS?

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BACKGROUND INFORMATION

# Context in England

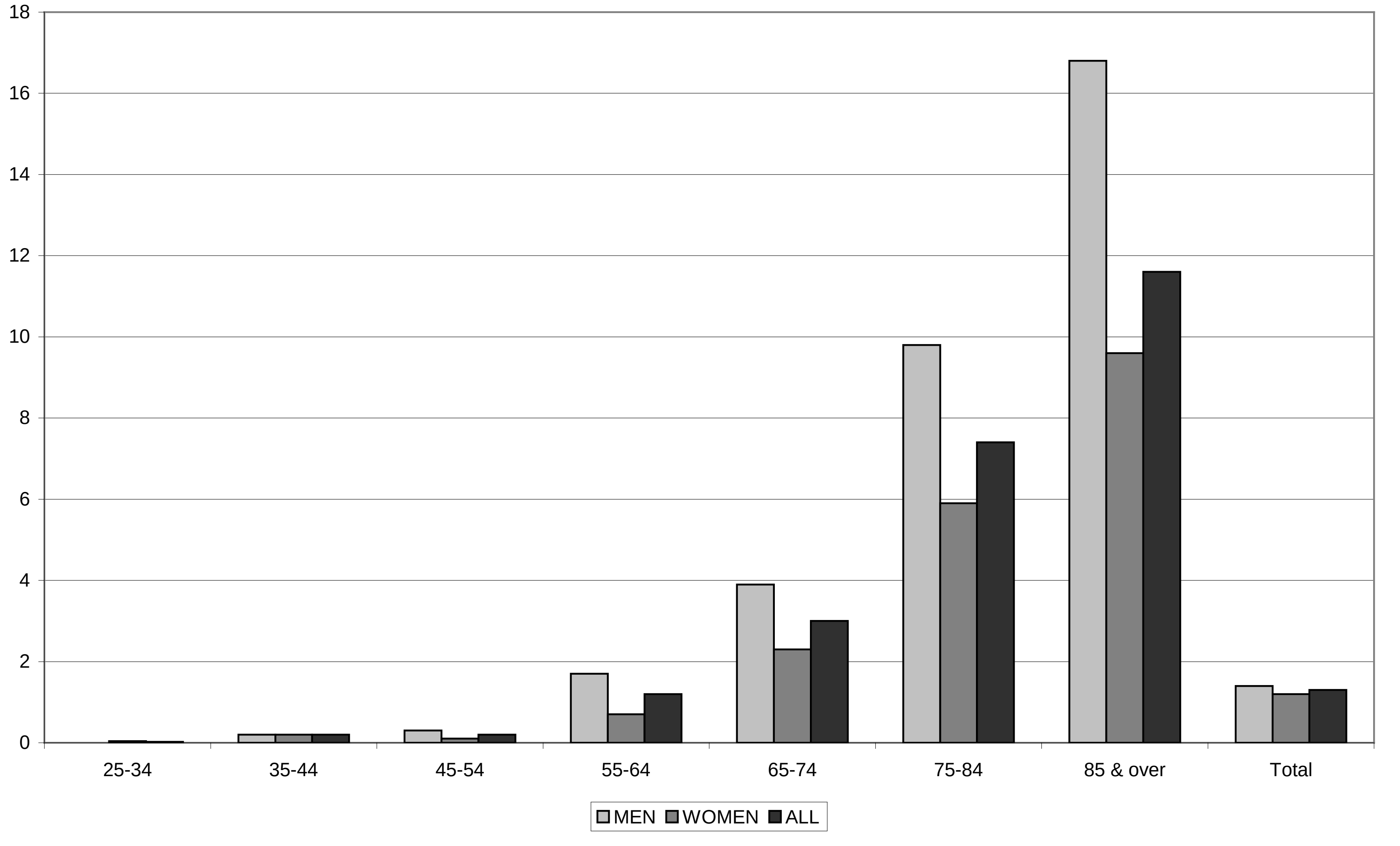
- Productivity formula (Atkinson formula) reflects increased production of health care services (in comparison to inputs), as well as improvements in quality of care and gains in health
- Need to understand the impacts of policies and priorities on the health of populations and on the new way of measuring NHS productivity
- This study is one of several studies… Estimating benefits from interventions on a common scale for populations, using a common framework

We present here a framework to measure current and potential health gains and associated costs of improving diagnosis and treatment of patients with Heart Failure

# What do we know about HF?

- “The term HF, as a clinical diagnosis, does not refer to any specific disease entity, but to a functional state in which **cardiac output is unable to meet the needs of the peripheral organs blood flow**, or is able to meet these demands **only with the help of compensatory mechanisms**” (Johansson et al. 2001)
- Complex aetiology
  - No single and universally agreed definition of HF
  - Much is known about the epidemiology of HF, but the presentation and aetiology are heterogeneous
- Patients with HF have significant impairment in all the aspects of physical and mental health, and declines in physical functioning
  - HF patients with lower QoL than patients with chronic lung disease or arthritis

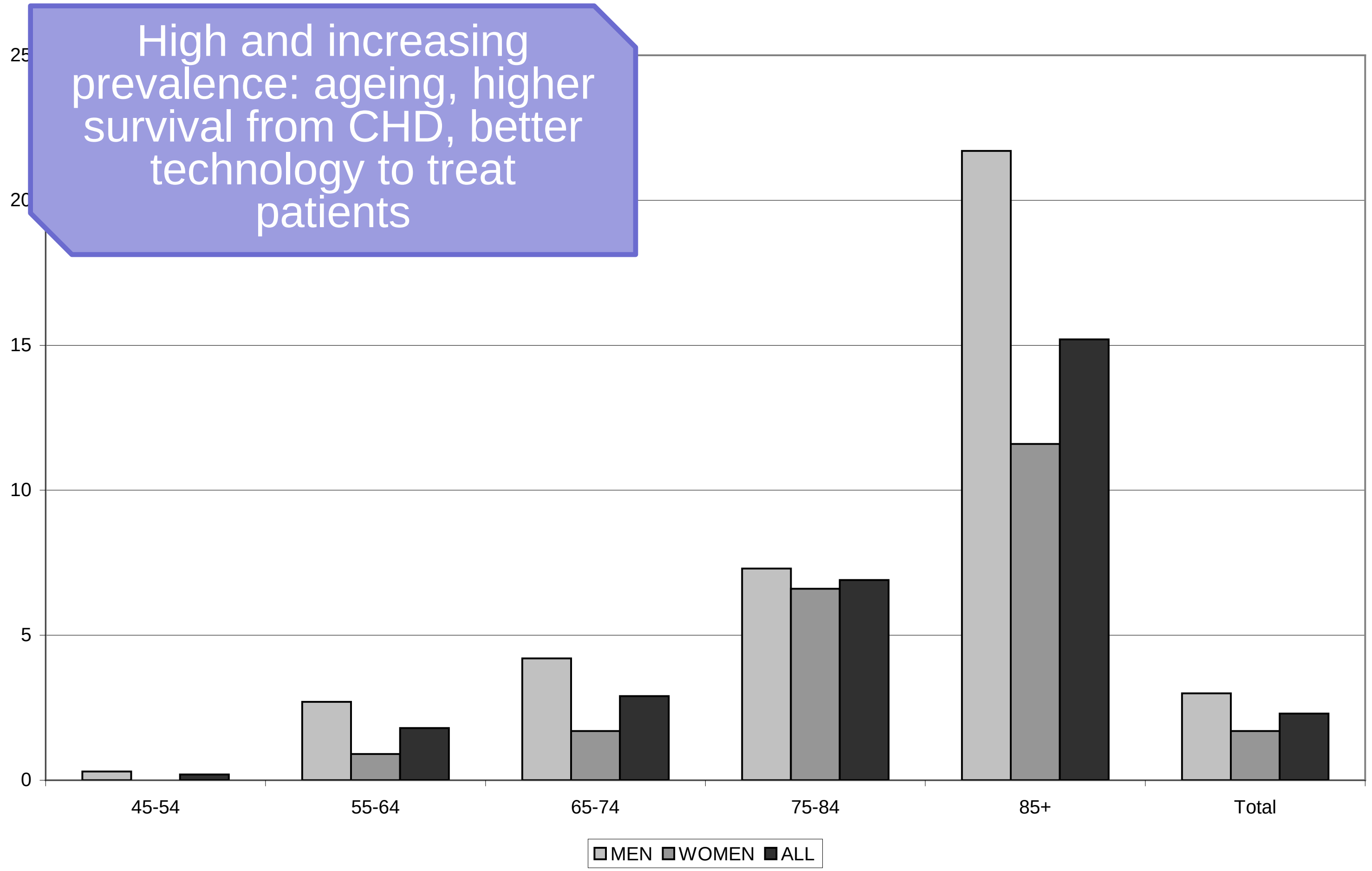
# HF incidence per 1000 population




Source: Cowie, Wood et al. (1999) (reference: Hillingdon population)

BACKGROUND INFORMATION

# HF prevalence per 100 population




Source: Davies, Hobbs et al. (2001) (reference: West Midlands population)

BACKGROUND INFORMATION

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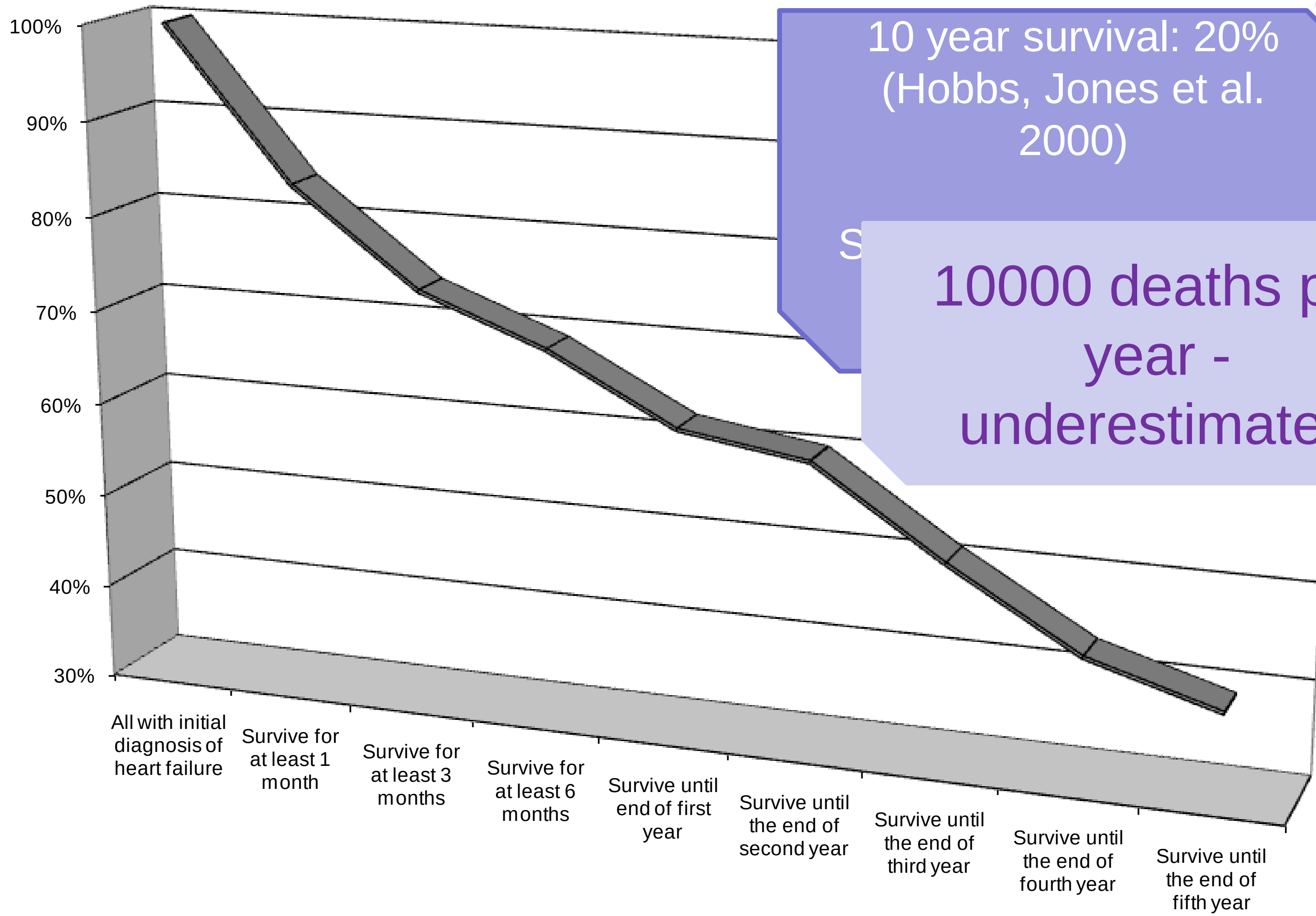
# Short survival and high associated mortality




10 year survival: 20% (Hobbs, Jones et al. 2000)

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10000 deaths per year - underestimated

Source: British Heart Foundation (2005)

**BACKGROUND INFORMATION**

The underlying cause and effective treatments for HF are well understood

& there are multiple evidence-based guidelines for treatment

& HF is treatable: the severity of symptoms and the trajectory of decline can slow considerably, with guideline-concordant care.

BUT....

# Gap between knowledge and effective delivery of guidelines of concordant care in the UK

- 80% of new cases identified through hospitalisation (Healthcare Commission 2007) → could have been diagnosed earlier
- 21% of cases not identified and hence not receiving treatment (Healthcare Commission 2007)
- Only 9% of suspected cases diagnosed after specialist referral (other cases diagnosis based on symptoms and/or signs) (Hobbs, Jones et al. 2000)
- Only 17% and 11% of diagnosed men and women undergoing an echocardiogram (Majeed, Williams et al. 2005);
- 83% of confirmed cases prescribed with an ACE inhibitor
- 93% of the cases had their diagnosis confirmed, and of those only 85% received initial treatment (Healthcare Commission 2007)
- Lower than 70% of cases complied with medication (Van der Wal, Jaarsma et al. 2005)

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# And which implies…

- HF accounts for (Bernard, Brody et al. 2007):
  - 1 million inpatient days (2% all NHS inpatient bed days)
  - 5% of all emergency medical admissions
  - an annual cost to the NHS ranging from £400m to £716m (about 2% of the total NHS budget)
- Most NHS costs are due to hospitalisation:
  - HF cases are frequently admitted to hospitals with long stays
  - 5% to 20% of medical beds are occupied by HF (Cleland 2002)
  - HF is one of the most common reasons for hospital admission and readmission to hospital in people aged over 60 years, and is present in many more admissions
- HF is expected to increase by 50% over the next 25 years (Bernard, Brody et al. 2007)

# To sum up…

High BoD and costs due to HF

↓

Undiagnosed and untreated cases of HF

↓

Scope for health gains

# Objectives of the study

- To estimate the health gains and costs associated with:
  - ✓ Earlier diagnosis of all cases identified by emergency admission
  - ✓ Providing treatment to all newly-diagnosed cases
  - ✓ Extending treatment to all diagnosed existing (prevalent) cases with primary and outpatient care
  - ✓ Treating with ACE inhibitors all the prevalent undiagnosed cases with Left Ventricular Systolic Dysfunction (LVSD)
  - ✓ Extending treatment to all prevalent cases diagnosed with ACE inhibitors (with LVSD)
  - ✓ Making patients to comply with use of ACE inhibitors.

- To test a QQUIP framework for analysis

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# The modelling approach to HF

- Micro-simulation population model
- Disease based model
- State transition model
  - **Starting point**: static model → All the individuals of the current population
  - **Time evolution in the model**: dynamic model → individuals/population groups evolving to different states (start having the disease, improve their health status, die, …); Transitions depend upon age, sex, NYHA functional status and treatment
- 'Interventions' change the dynamics of the model
  - Computation health gains and costs associated with the interventions

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# Static model: Population groups in year t

- Healthy population
- Identified initial prevalent population (by age, sex and NYHA)
  - Being treated
  - Not being treated
- Unidentified initial prevalent population (by age, sex and NYHA)
  - Not being treated
- Incident population in previous years within the model (by age, sex and NYHA)
  - Being treated
  - Not being treated

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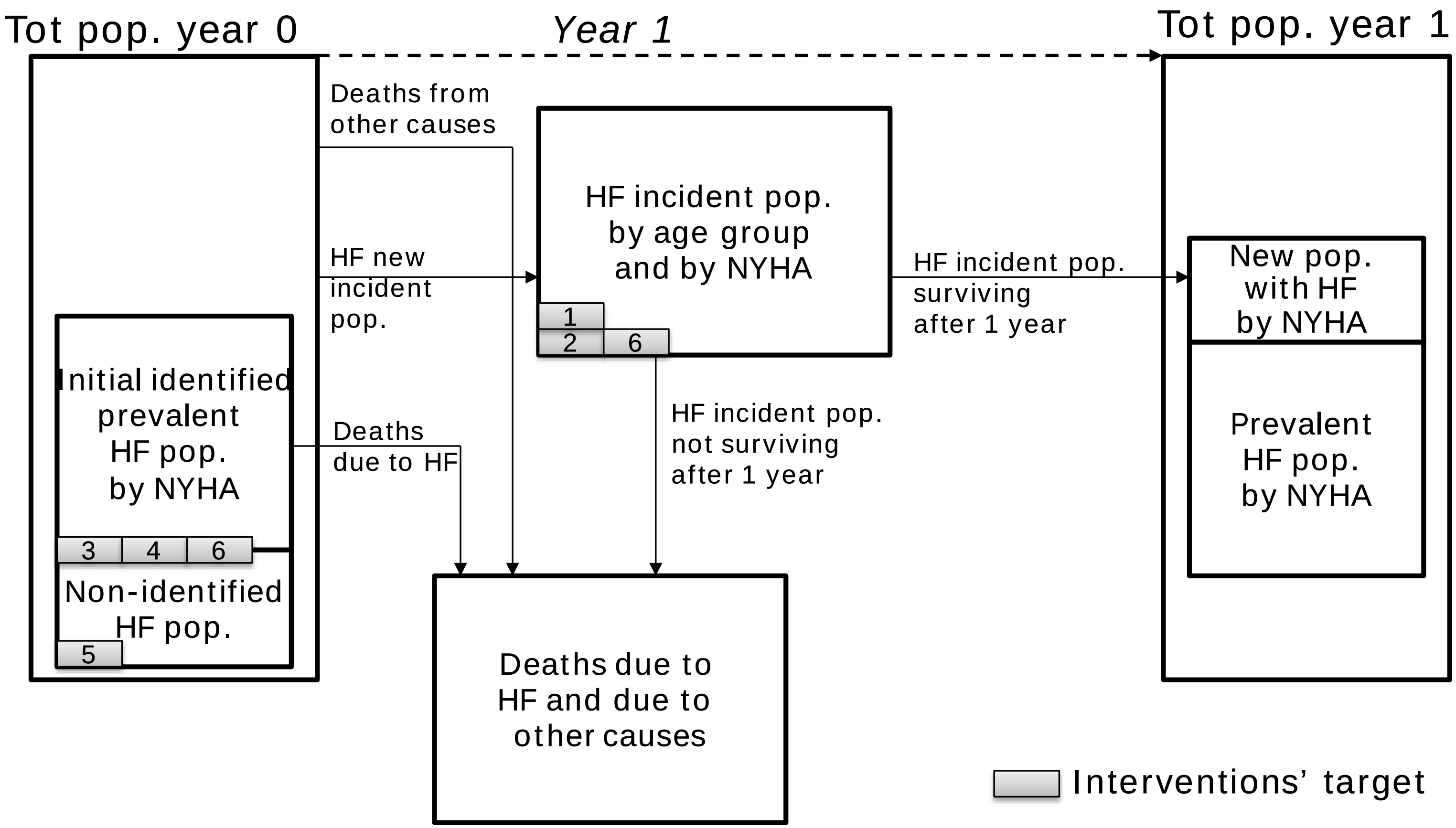
# Dynamic model: 1st year

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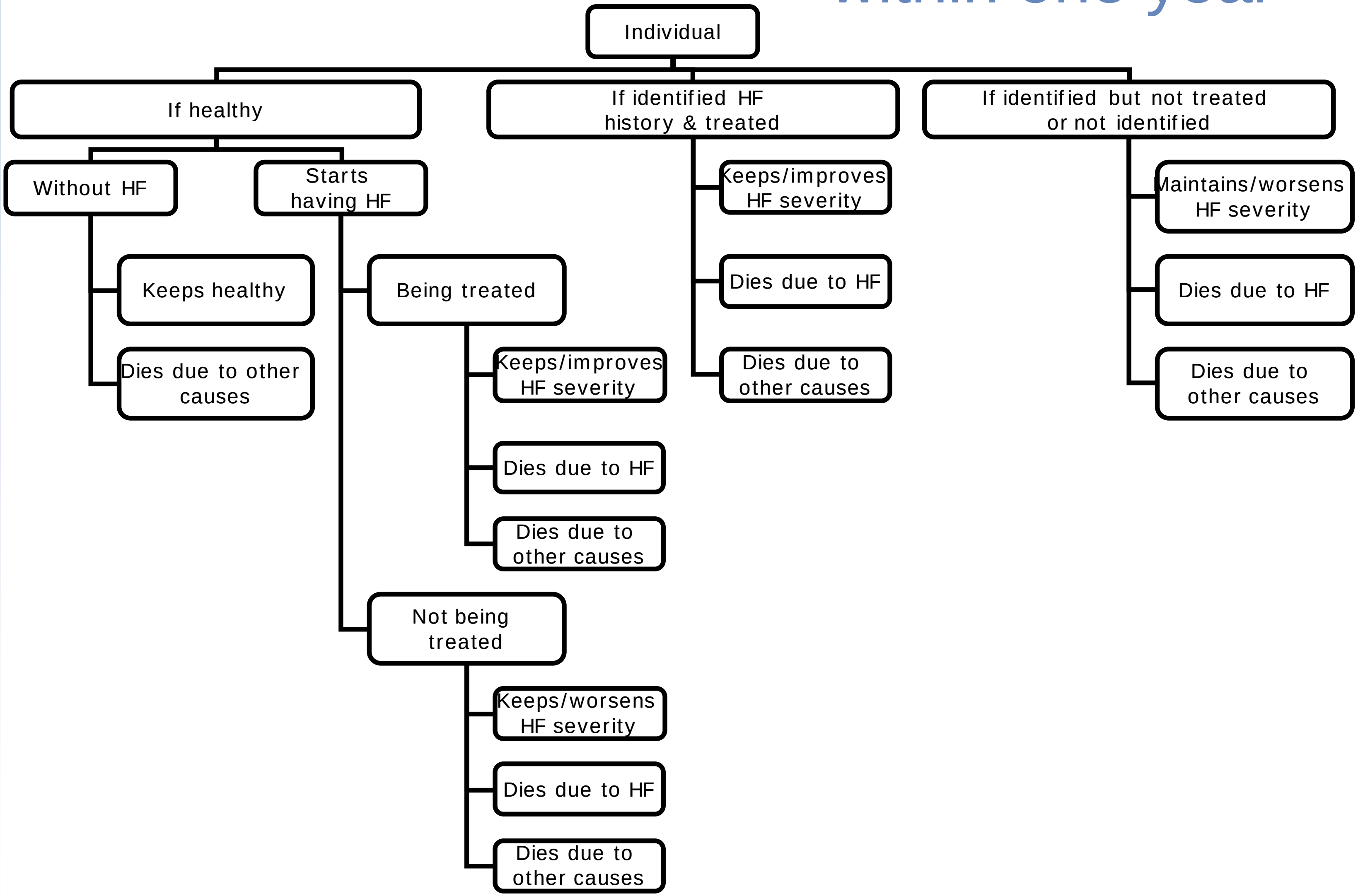
# Micro-simulation: Individuals’ evolution within one year

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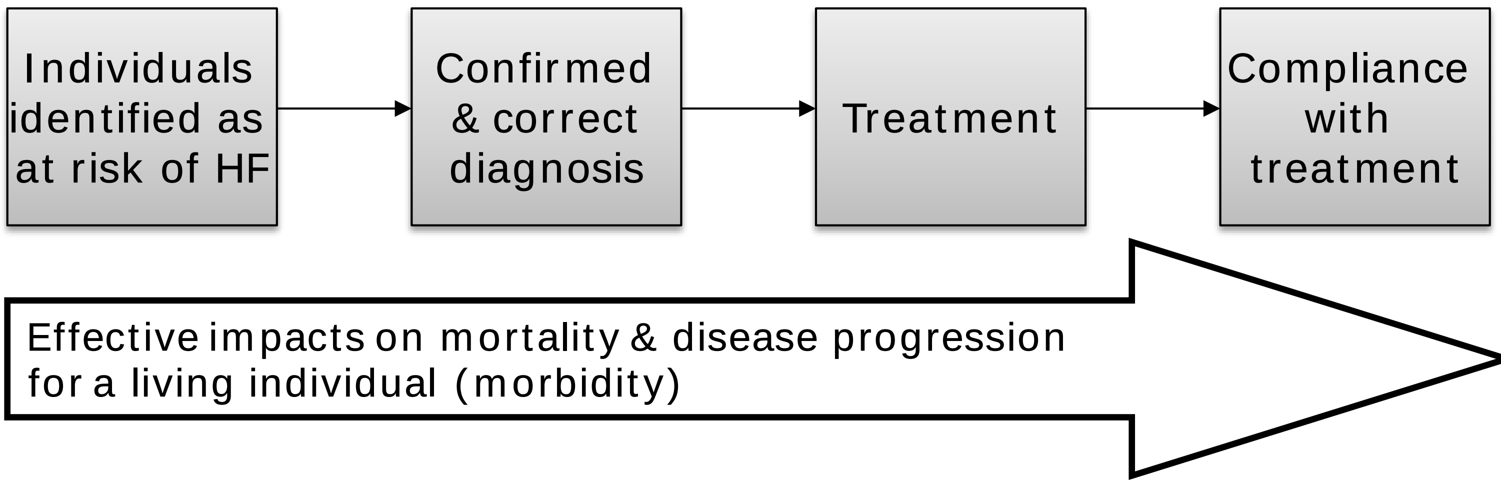
METHOD.
APPROACH

# HF patient ‘pathway’ for effective delivery of treatment

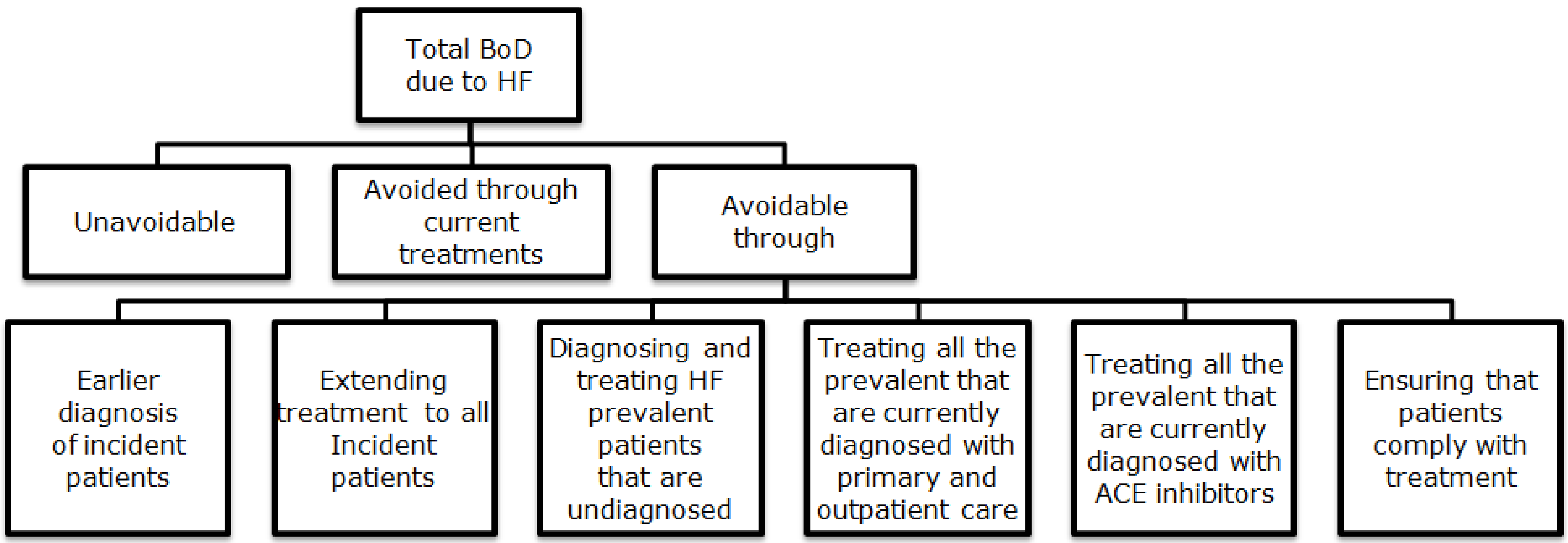



METHOD.
APPROACH

# Intervention Scenarios

| **Intervention scenarios** | Description |
|---|---|
| No treatment (A) | There is no delivery of any type of treatment. |
| Current case (B) | Status quo in 2005 |
| Treat incident (C) | (B) with all the incident population being delivered treatment |
| Earlier diagnosis incident (D) | (B) with an earlier diagnosis of the incident population that has being diagnosed through hospitalisation |
| Treat prevalent (E) | (B) with follow up in the primary and outpatient care of all the prevalent patients being diagnosed with HF |
| Diagnose undiagnosed patients (F) | (B) with the undiagnosed prevalent population with HF being diagnosed and treated |
| Extend prescription ACE (G) | (B) with all the patients diagnosed with HF and with LVSD being prescribed with ACE inhibitors |
| Extend compliance (H) | (B) with all the patients being prescribed with ACE inhibitors complying with treatment |
| All interventions simultaneous (I) | All the interventions defined in (C), (D), (E), (F), (G) and (H) being applied simultaneously |

# Decomposition of the Total BoD due to HF

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METHOD. APPROACH

# Measuring outputs

- Deaths, YLL, QALYs, expected health outcomes
- QALY metric both to measure the current BoD of different diseases and health benefits from selected interventions
- How can the bulk of resources be effectively used?
  - Number of people affected by the intervention
  - Direct costs
  - Net monetary value of deaths (deaths → £1.145m at 2000 prices)
  - Net monetary value of QALYs (QALY → £30k)

# Costing HF interventions

| Cost component | Mode of computation |
|---|---|
| Primary care, outpatient care and outpatient investigations costs | Mean annual number of GP consultations per person with HF treated * Costs per GP consultation<br>+ Mean annual number of referrals to secondary outpatient care per patient with HF treated<br>* Costs per secondary outpatient care attendance<br>+ Annual cost per outpatient investigation per HF patient |
| Hospitalization costs | Mean annual number of Inpatient visits to hospital for each type of HF patient<br>* Average length of stay<br>* Costs per hospital admission day |
| ACE Prescription costs for prescribed population | Mean number of prescriptions per individual with HF<br>* Cost per prescription |
| Prescription costs per newly diagnosed patient | Costs of diagnosing HF for patients with LVSD and initiating treatment |

# Sensitivity Analysis

- Increasing death rates due to HF
  - Underreporting of deaths due to HF because of death coding rules
- Increasing the incidence rate for HF by 10% a year
  - Rise in incidence due to an increasing incidence and prevalence of CHD, an increasing survival from CHD and the ageing of the population
- Lowering the level of compliance to drugs
- Lowering the LOS in hospitalisation
  - the LOS for HF has been reducing in recent years
- Lowering the monetary value of a QALY for health gains to £20,000

# RESULTS

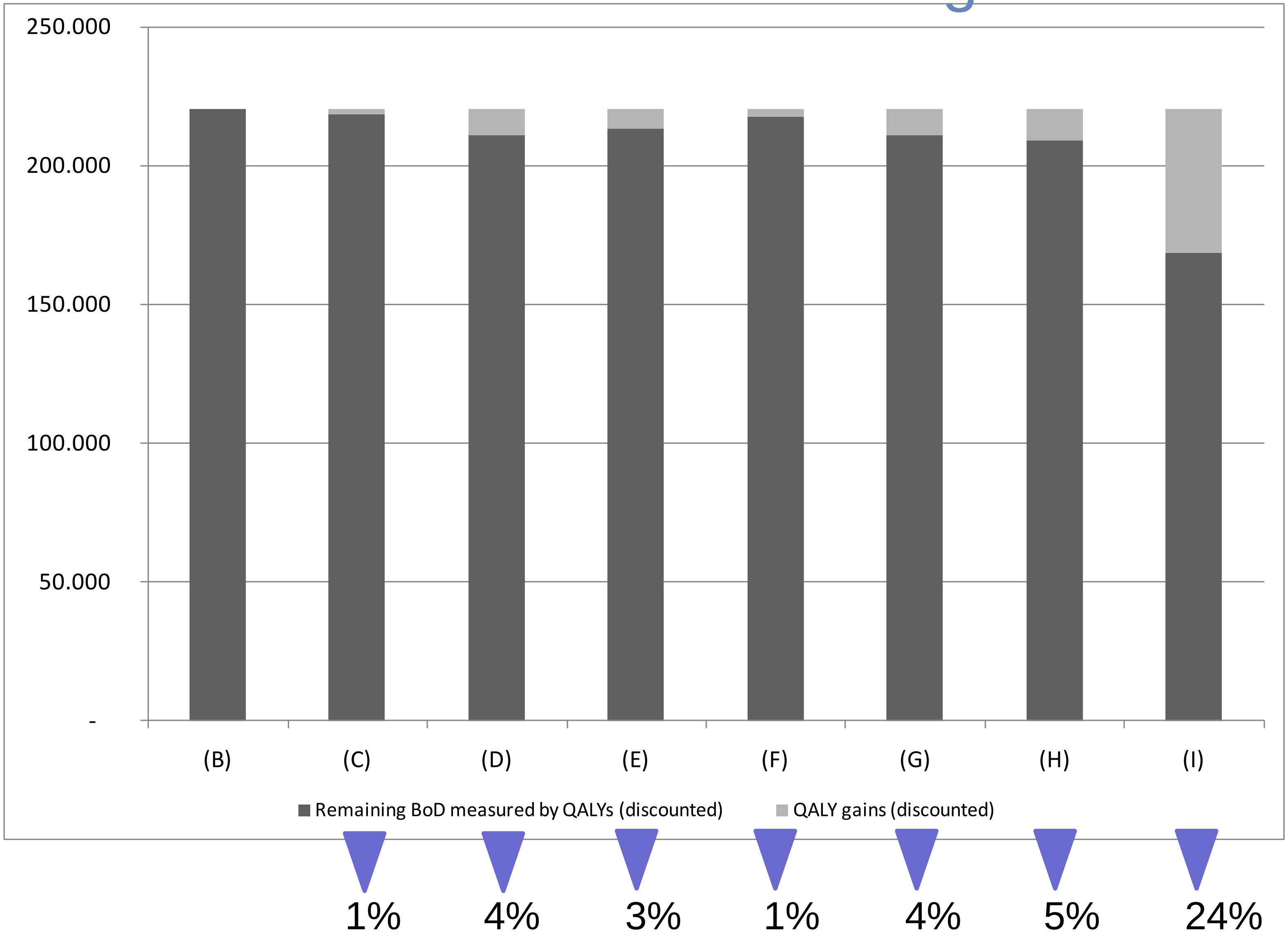
Model run for 5 years and for England

Annual figures reported

# ’Avoidable’ outcomes and extra NHS direct costs for the intervention scenarios

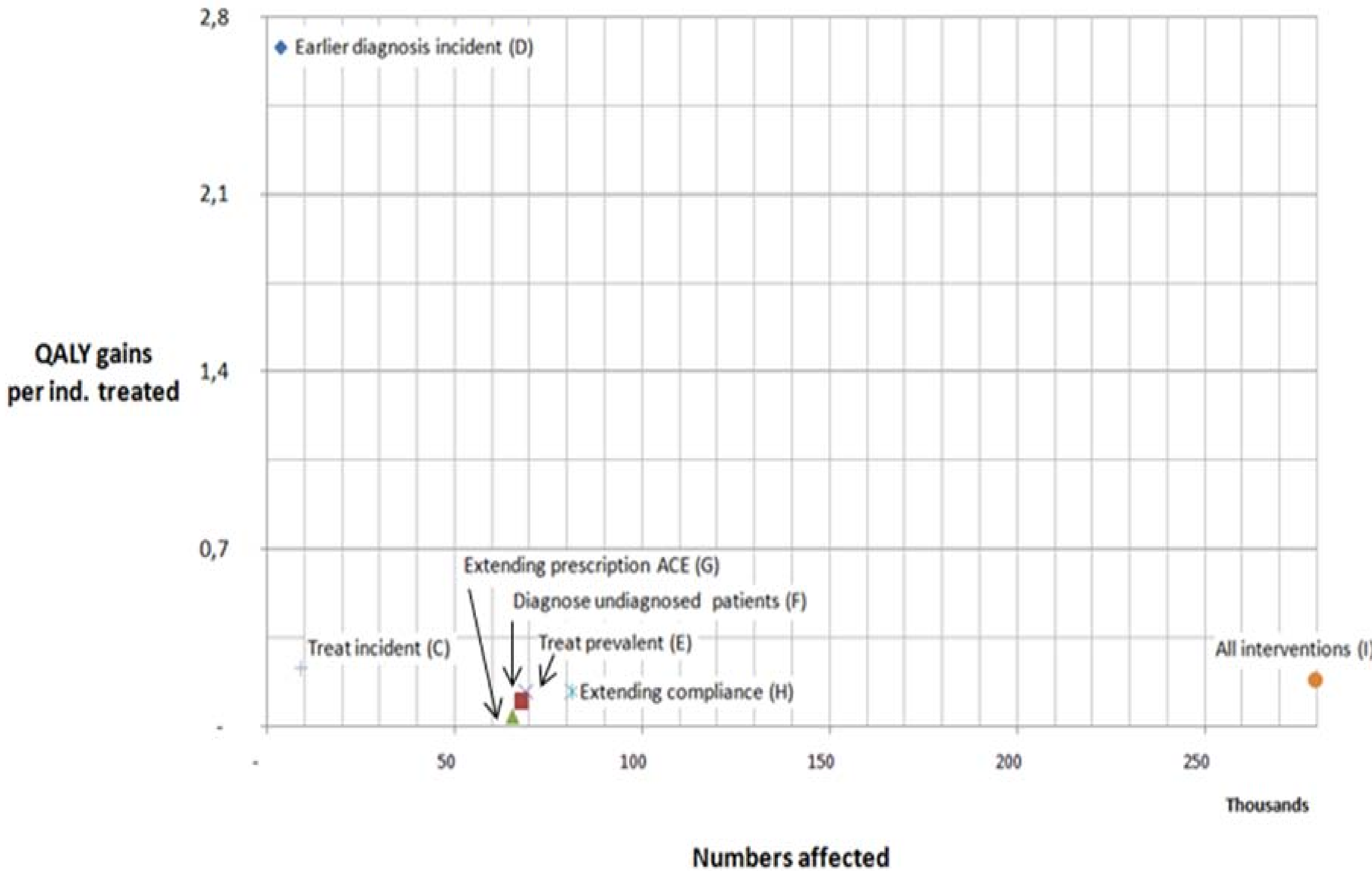
| **OUTCOMES** | Treat incident (C) | Earlier diagnosis incident (D) | Treat prevalent (E) | Diagnose undiagnosed patients (F) | Extend prescription ACE (G) | Extend compliance (H) | All interventions (I) |
|---|---|---|---|---|---|---|---|
| HF Deaths | -50 | -150 | -180 | -100 | -240 | -290 | -1,310 |
| YLLs discounted | -120 | -380 | -500 | -250 | -680 | -770 | -3,460 |
| QALYs of individuals living with HF discounted | 1,900 | 9,100 | 6,500 | 2,500 | 8,900 | 10,600 | 48,300 |
| Number of individuals living with HF | 600 | 10,000 | 3,200 | 1,600 | 4,400 | 4,700 | 29,400 |
| QALY gains (discounted) | 2,100 | 9,500 | 7,000 | 2,700 | 9,600 | 11,300 | 51,800 |
| **COSTS (£ms)** | | | | | | | |
| Total costs (discounted) | 10 | 10 | 35 | 35 | 50 | 20 | 130 |

# Total BoD in the status quo (scenario B) and the scope of different interventions decreasing the BoD




RESULTS

# Average QALY gains per treated individual and number of individuals treated in each intervention scenario




RESULTS

# Net monetary value of health gains for the intervention scenarios

| **Valuation of health gains** | Treat incident (C) | Earlier diagnosis incident (D) | Treat prevalent (E) | Diagnose undiagnosed patients (F) | Extend prescription ACE (G) | Extend compliance (H) | All interventions (I) |
|---|---|---|---|---|---|---|---|
| 'Avoidable' deaths | 50 | 150 | 180 | 100 | 240 | 290 | 1,310 |
| QALY gains (discounted) | 2,100 | 9,500 | 7,000 | 2,700 | 9,600 | 11,300 | 51,800 |
| Additional costs (discounted) (£ms) | 10 | 10 | 35 | 35 | 50 | -20 | 130 |
| Monetary value of deaths (£ms) | 60 | 180 | 210 | 120 | 280 | 330 | 1,500 |
| Net monetary value of deaths (£ms) | 50 | 170 | 170 | 80 | 230 | 350 | 1,370 |
| Monetary value of QALYs (£ms) | 60 | 290 | 210 | 80 | 290 | 340 | 1,550 |
| Net monetary value of QALYs (£ms) | 50 | 280 | 180 | 50 | 240 | 360 | 1,420 |

5º 2º 4º 5º 3º 1º

RESULTS

# Results from Sensitivity Analysis

- Increases in incidence and death rates naturally increase the BoD and also the potential for health gains from the selected interventions
- Reclassifying mortality rates for the prevalent population, with more due to HF and less to other causes shows our estimates are sensitive to death rates.
- When there are reductions in the hospital LOS or the QALY value, the net value of health gains from the interventions is still positive.

Overall, results of sensitivity analysis indicate that baseline estimates of the model tends to underestimate the monetary value of health gains.

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# Discussion

- Simple model looks at a small number of potential interventions to reduce the BoD associated with HF & approximate estimates of the incremental costs associated with these interventions were produced
- Modelling approach allows for a new way of looking at the problem of allocating resources to different interventions to reduce the BoD, by estimating the expected impacts on the health of the population and the budget.
  - This gives comparisons in terms of order of magnitude and is intended to inform those responsible for developing and implementing health policies.

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# Concluding remarks

- The current BoD due to HF is approximately 220,000 QALYs (discounted) and the potential reduction in the BoD is as follows:
  - 5% from improving compliance with ACE inhibitors;
  - 4% from earlier diagnosis of incident patients and extending prescription of ACE inhibitors;
  - 1% and 3% from extending treatment to diagnosed incident and prevalent patients might generate gains of respectively.
- Highest net monetary gains due to:

  1st Extending compliance; 2nd Earlier diagnosis of the incident patients; 3rd Extending prescription of ACE inhibitors;4th Treating the prevalent

**Scope and need for developing these approaches!**

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CONCLUDING REMARKS