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# Identifying high risk individuals for care management in primary care

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- Predictive modelling
- Outline of a study identifying high risk identification in primary care
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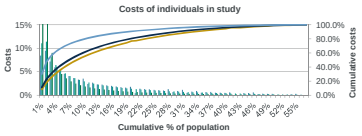
## High cost

- High-cost individuals constitute small proportion of population but large proportion of all costs



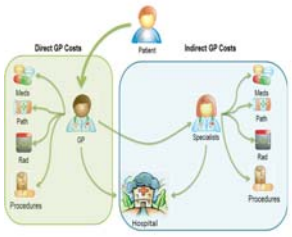

- Allows for targeted interventions to high cost individuals that represent the greatest opportunity to reduce costs

## Care management

- Care management aims to provide the most appropriate care for patients in order to manage costs and improve health outcomes
- Shift away from treating illness to managing health status
- The care management process consists of :
  - Identifying individuals who exhibit common characteristics
  - Ranking individuals according to a risk factor
  - Making use of that ranking in planning a programme



## The role of GPs in care management



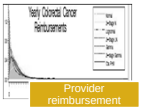

- GPs effectively control much of the treatment process
  - GPs own costs
  - Costs directly generated by GPs
  - Costs generated downstream of GPs
- GPs thus offer great opportunity for care management



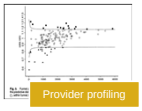
## UK relevance

- Health and Social Care Act 2012 gives GP-led Clinical Commissioning Groups direct oversight for local NHS services
  - Elective hospital care
  - Rehabilitation care
  - Urgent and emergency care
  - Most community health services
  - Mental health and learning disability services
- Concerns about fragmentation of care planning for patients with comorbidities and frail and elderly
- Large number of GP consortiums result in smaller population groups and increased chances of few expensive patients blowing a hole in budgets

## Predictive modelling in healthcare

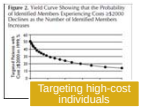



Provider reimbursement



Provider profiling


Underwriting and pricing



Targeting high-cost individuals

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## Why predictive modelling?

- Predictive modelling is forward looking, allowing programmes to target individuals predicted to be at high risk in the future- Patients should be identified **before** the occurrence of adverse outcomes resulting in high costs
- Mean reversion in costs mean that individuals shift between cost categories- Important to identify individuals currently at lower risk who might become higher risk in future
- Predictive modelling can make use of a wealth of risk factor data available in patient profiles to inform predictions

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## Questions to answer

- Who are the future high cost individuals?
- What are their common characteristics?
- What are the implications of common characteristics for interventions?

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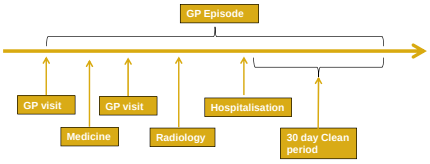
## Study setting

- South African medical scheme environment
- Significant cost escalation pressures
- Medical Schemes governed by regulations which require
  - Schemes operate on basis of social solidarity
  - Open enrolment but membership not mandatory
  - → **Inability to exclude or underwrite**
  - Prescribed set of minimum benefits
  - Benefits paid at "Full cost"
  - → **Open ended liability**



## Grouping by GP costs by episode

- Patients allocated to GPs based on utilisation data
- All healthcare costs stemming from initial GP visit are grouped into an episode using an algorithm






## Modelling approach

- Risk score derived for individuals for three categories of costs within episodes
  - GP costs
  - Costs directly generated by GPs (eg acute medicine, pathology, radiology, specialist referrals)
  - Indirect costs (eg. hospital costs, generated specialist costs)
- Risk scores were based on predictive models which forecasted costs per life per year
- Costs not usually stemming from GP care will not play a large part eg. maternity and trauma
- Many different possible algorithms for identifying risk of individuals

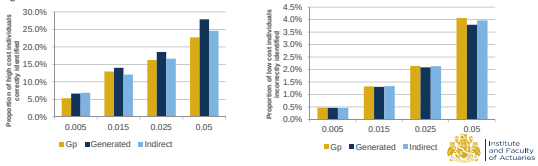
## Modelling Technique

- Large number of individuals with zero cost
- Thus two part linear model used to model number of episodes and cost per episode given an episode occured
  - Number of episodes modelled using GLM with Negative Binomial response
  - Cost per episode modelled using GLM with Gamma response and log-link
  - Number of episodes included as additional independent variable
- Dependent variables in year 1 used to predict costs in year 2
- Models evaluated on separate validation sample to avoid overfitting
- Identification of high-risk individual consists of stratifying individuals in terms of a risk score derived from predicted cost



## Modelling results- model accuracy

- Accuracy of model can be evaluated based on sensitivity and specificity of identifying high risk individuals
- Can not construct Receiver Operating Characteristic Curve at all thresholds as a result of large proportion of zero claiming individuals. Sensitivity and specificity are rather be shown for selected high thresholds



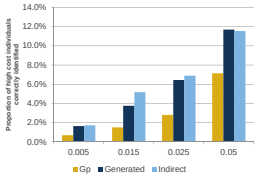


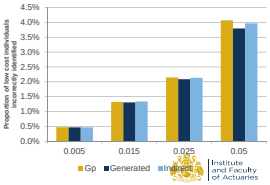




## Model accuracy- previously low risk

- Beneficiaries who are predicted to transition from low to high risk are identified with less sensitivity, in particular GP costs.
- However identification is with greater accuracy that random allocation



## High risk characteristics

- Threshold of 1.5% of beneficiaries considered to be most ideal for intervention in this study
- Characteristics of high risk individuals are indicative of resource allocation

| | GP costs | Generated GP costs | Indirect costs |
|---|---|---|---|
| Average age | 52.6 | 61.9 | 66.0 |
| Female | 71.8% | 71.6% | 65.2% |
| At least one chronic condition | 89.3% | 99.1% | 99.1% |

- Characteristics vary considerably for different categories of cost

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## High risk chronic conditions

- High risk individuals are associated with multiple chronic comorbidities

| | GP costs | Generated GP costs | Indirect costs |
|---|---|---|---|
| Hypertension | 76.2% | 86.2% | 79.5% |
| Diabetes Melitis | 25.6% | 43.0% | 38.5% |
| Hyperlipidaemia | 37.0% | 55.9% | 42.8% |
| Mental disorders | 58.1% | 63.3% | 62.4% |
| Heart conditions | 37.2% | 45.9% | 59.0% |
| COPD and athma | 74.2% | 69.5% | 68.4% |

  - GP Generated cost are closely associated with multiple chronic conditions
  - Heart conditions are a large indicator of individuals at high risk of indirect costs
  - COPD and Asthma are indicators of high risk of GP costs

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## High risk acute consitions

- GP costs are most highly associated with acute disease burdens for GP costs
- Indirect costs are less associated with acute disease burdens. However acute disease are still prevalent and may be brought upon by existing chronic conditions

| | GP costs | Generated GP costs | Indirect costs |
|---|---|---|---|
| Influenza | 30.1% | 18.7% | 9.4% |
| Acute bronchitis | 90.4% | 84.2% | 65.7% |
| Infectious diseases | 27.6% | 23.4% | 23.4% |

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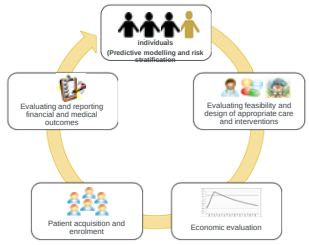
## The full care management process






## Predictive modelling in the UK

- **Patients at Risk of Re-hospitalisation (PARR) in England**
  - Built using HES sample
  - Can be run by NHS organisations based on own data
  - Only able to predict individuals with recent hospitalisation
- **Predictive Risk Stratification Model (PRISM) in Wales**
  - Run on combination of hospital and GP data
  - Run centrally and results available to GPs through website
- **Combined Predictive Model in England**
  - Built using combination of hospital and GP data
  - Allows stratification of entire registered population
  - Algorithm provided to NHS organisation, but software must be built locally
  - GP practices may not always have electronic records
- **Scottish Patients at Risk and Admission (SPARRA)**
  - Analogous to PARR
  - Results sent to each Health Board



## The future

- Clinical Commission Groups represent an opportunity to predict healthcare expenditure at individual and practice levels
- Further investigation of different methodologies to stratify NHS beneficiaries can be performed, such as the SOA grouper studies in the US
- Patient level data can be linked from multiple sources (Importance of not breaching confidentiality where treatment may be affected by a risk score)
- Models that predict risk can be accompanied by models that predict impactability of conditions

## Questions

## Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.