Decision and Evaluative Sciences

Or

“Mind the Gap”
....From knowledge to action

Knowledge
• 1601 - Lemon juice could prevent scurvy among sailors

The Gap
• 250 years

The policy response
• In 1864 the British Board of Trade provided citrus for its sailors

Source: Sax Institute 2009
....From knowledge to action

Knowledge
• Relationship between asbestos and lung cancer in 1955

The Gap
• 20 years/40 years

The policy response
• Asbestos banned in Australian manufacturing in 1975 and banned completely in 2003

Source: Sax Institute 2009
Mind the Gap

• *Mind the gap* from knowledge through to improvements in population health.

• It requires judgment, decision making, implementation and evaluation

• *Translational research* is NOT a new concept
Source: Gapminder.org/world/......
Gapminder has the facts – what about values?

• What, if anything, explains the changes over time?

• Examination of individual, household, community and system wide influences

• Evaluation
Outline of this talk

• What are the decision and evaluative sciences?

• A framework for thinking about decision making under conditions of uncertainty

• Empirical application in public health
  - HERMES
  - FMRC
Disclaimers

We all do it (use judgment and make decisions under conditions of uncertainty)

_Homo economicus_ [rational man – _sic_) is an endangered species, but our future does depend upon making good decisions

I will not dwell on policy (that was covered in Steve Leeder’s seminar topic)
Choice under uncertainty

NO! NO!
FOR GOD’S SAKE,
DON’T USE
YOUR OWN
BEST JUDGMENT!
Decision Sciences

• Theory of decisions under uncertainty

“There is no such thing as absolute certainty, but there is assurance sufficient for the purposes of life”.

John Stuart Mill
Uncertainty and the need for judgment

Decision theory is normative (how people should make decisions under uncertainty) often accompanied by heroic assumptions

- decision makers are fully informed
- able to process probabilistic information accurately
- rational
In the real world

• Descriptively, people are not rational decision makers

• We are often not even aware of our judgment and decision processes

• There is rivalry between intuition and analysis in our cognitive approach to decision making
OUTLIERS
The STORY of SUCCESS
MALCOLM GLADWELL
Author of The Tipping Point and Blink
Exemplifications:

Knowledge generation
- Non-cognitive judgement
- Clinical judgement
- Expert consensus judgement
- Descriptive (positive) model
- Case-control study
- Randomized controlled trial

Decision/policy making
- Non-cognitive decision
- Clinical judgement
- Expert consensus decision
- Decision (normative) model
Knowledge Technologies

Truth-Focused

Decision-focused

Valuation Technologies

Decision Technologies

'HARD'

'SCIENCE'

'MIDDLE'

'SCIENCE'

'BAYESIAN'

'SCIENCE'

PREFERENCE

ESTABLISHING

BAYESIAN

DECISION

ANALYSIS

PRINCIPLES

PROCESSING

TAKING INTO

ACCOUNT

and

BEARING IN MIND

Source: J Dowie
A framework

- KNOWLEDGE → PREFERENCES → DECISIONS/EVAL

  the patient
  the community

  Cost effectiveness
  Equity analysis
  Labour force
  HSR, Health Systems
  Policy
Who dabbles in these dark arts?

• Health Economics Collaboration

• Family Medicine Research Centre

• SOuRCe (Surgical Outcomes Research Centre)

• Subscribers of “KIDS” (Knowledge interaction decision support)
Health Economics Collaboration

• **Stephen Jan** (George Institute & CIA - NHMRC Capacity Building grant in Health Economics)
  
  • Alison Hayes (SPH)
  • Beverley Essue (GI)
  • Deborah Schofield (CTC and SPH)
  • Edmund Fitzgerald (SPH)
  • Glenn Salkeld (SPH)
  • Germaine Wong (CHW, SPH)
  • Joel Negin (SPH/Menzies)
  • John Chalmers (GI)
  • Kirsten Howard (SPH)
  • Marian Shanahan (UNSW)
  • Michelle Cunich (SPH)
  • Philip Clarke (SPH)
  • Rachael Morton (SPH)
  • Steve Leeder (SPH/Menzies)
  • Tracey-Lea Laba (GI/Pharmacy)
Kirsten Howard & colleagues

Knowledge

Preferences

Decisions/Evaluation

the patient

the community

Cost effectiveness

Equity analysis

Labour force

HSR, Health Systems

Policy
Preferences

• Patient preferences for health states (utility-based QOL assessment)
  – QUICK – QOL in CKD (GW/AT)
  – QOL in adolescent transplant recipients (AT/RM)
  – Trial based QOL assessment
    • ACTIVE dialysis (AC + GI renal group)
    • WEBB trial – post hospital falls prevention (CS)
    • HOP-STEP – post hip and pelvic fracture falls prevention (CS)
Preferences

• Preferences for health services (DCE)
  – Patients
    • Preferences for dialysis modality (RM)
    • Preferences for delivery of acute care services in RACF (GA)
    • PArADOx – Preferences for the Allocation and Donation of Organs (SJ/AC/JR/SC/RA)
    • OPRA – outpatient cervical priming for labour induction (DT, KG)
Preferences

• Preferences for health services (DCE)
  – Community
    • Preferences for delivery of acute care services in RACF (GA)
    • PArADOx – Preferences for the Allocation and Donation of Organs (SJ/AC/JR/SC/RA)
    • Prostate Cancer screening
Cost-effectiveness analysis

• Trials
  – ACTIVE dialysis – cost per QALY gained
  – WEBB trial – cost per fall prevented, cost per QALY gained
  – HOP-STEP – cost per fall prevented, cost per QALY gained

• Models
  – Screening for RCC (GW)
  – Economic impact of CKD in Australia (AC/SM)
  – Screening for renal indicators in patients with Type 1 & 2 diabetes (PC, GW)
KNOWLEDGE

PREFERENCES

the patient

the community

DECISIONS/EVAL

Cost effectiveness

Equity analysis

Labour force

HSR, Health Systems Policy
Health economics of chronic disease

• Broad range of work being conducted in SPH including:
  – Estimating costs, outcomes and cost-effectiveness of interventions for people with diabetes (with Alison Hayes, Tom Lung & Germaine Wong)
  – Simulation of outcomes & disease processes (with Alison Hayes & Patrick Kelly)
  – High price of generic medications in Australia (with Ed Fitzgerald)
  – Measuring health inequalities (with Alison Hayes)
  – Changing access to dental care (with Ed Fitzgerald & Michelle Cunich)
Rating of health & future events

Vascular events

Cumulative hazard (%)

Time (years) since EQ5D survey

Source: Hayes, et. al. Diabetes Care 2008
Diabetes simulation modelling

Ischaemic heart disease (IHD)
AGE 1.03
FEMALE 0.62
HbA1c 1.13
SBP 1.10
Ln (TOTAL:HDL) 4.47
(Eq.1, 231 events)

Fatal and non-fatal myocardial infarction (MI)
AGE 1.06
FEMALE 0.44
AC 0.27
SMOK 1.41
HbA1c 1.13
SBP 1.11
Ln (TOTAL:HDL) 3.29
IHD 2.49
CHF 4.75
(Eq. 2, n = 495)

Heart failure (CHF)
Age 1.10
HbA1c 1.17
SBP 1.12
BMI 1.07
(Eq. 3, n = 97)

Blindness (BLIND)
AGE 1.07
HbA1c 1.25
(Eq. 6, 104 events)

OTHER DEATH
(In force at all times)
AGE x FEMALE 1.08
AGE x (1-FEMALE) 1.11
SMOK 1.36
(Eq. 10, 250 deaths)

Renal failure (RENAL)
SBP 1.50
BLIND 8.02
(Eq. 7, 24 events)

Amputation (AMP)
PVD 11.42
HbA1c 1.55
SBP 1.25
BLIND 6.12
(Eq. 5, 40 events)

Diabetes related mortality
EVENT FATALITY (odds ratios)
(In year of first event)
Ln (AGE_EVENT) 16.00
HbA1c 1.12
MI_EVENT 14.01
STROK 2.85
RENA 1.00
AMP 1.00
CHF 1.00

DIABETES MORTALITY
(In subsequent years)
Ln (AGE_EVENT) 113.40
TOTAL:HDL 1.12
MI_EVENT 51.38
MI_POST 3.06
STROKE_EVENT 16.56
STROKE_POST 1.00
CHF 1.00
AMP 2.81
RENA 4.88
(Eq. 9, 100 deaths)

UKPDS 68, Diabetologia 2004
Pricing of generics in Australia

Australia could save:
- $2.5 billion over the next ten years by paying UK prices for generic statins
- up to $8 billion if generics were used in preference to patented drug
Inequalities in CVD risk factors

**Smoking**
- 1989
- 2005

**Overweight or obese**
- 1989
- 2001
- 2005
Dental research: Inequality of access

Aged over 65: “Visiting a dentist in the last 12 months”

Proportion using a dentist

Years


Lowest quintile
4th Quintile
3rd Quintile
2nd Quintile
Highest Quintile
International links

• Active collaborations with a number of other research groups:
  – Tom Van Ourti : Erasmus University (inequality research)
  – David Meltzer : University of Chicago (Using economics to improve clinical trial design)
  – Josh Salomon : Harvard School of Public Health (Diabetes, quality of life)
  – Ulf Gerdtham : University of Lund (Diabetes, inequalities research)
  – Alastair Gray & other health economists : Oxford University (Diabetes)
Deborah Schofield & colleagues

KNOWLEDGE

PREFERENCES

the patient

the community

DECISIONS/EVAL

Cost effectiveness

Equity analysis

Labour force

HSR, Health Systems Policy
Survey of Disability, Ageing and Carers
Income group, government payments, disability, chronic conditions, retirement, demographic variables

Health&WealthMOD
Base Population

Simulate economic impacts
Personal:
Lost earnings

Government:
Lost tax
Transfer payments

Reweighting

STINMOD
Tax
Transfer payments
Personal income
Odds ratio of being out of labour force associated with various long term health conditions with reference group “no condition” and the lost work force due to long term health condition

<table>
<thead>
<tr>
<th>Long-term health condition</th>
<th>Crude OR (95% CI)</th>
<th>P-value</th>
<th>Adjusted OR# (95% CI)</th>
<th>P-value</th>
<th>AR%(^i)</th>
<th>Lost work force(^j)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back problems (dorsopathies)</td>
<td>3.45 (2.92, 4.07)</td>
<td>&lt;.0001</td>
<td>3.59 (2.98, 4.33)</td>
<td>&lt;.0001</td>
<td>72.1</td>
<td>144764</td>
</tr>
<tr>
<td>Arthritis and related disorders</td>
<td>4.79 (4.02, 5.71)</td>
<td>&lt;.0001</td>
<td>3.06 (2.52, 3.73)</td>
<td>&lt;.0001</td>
<td>67.4</td>
<td>134318</td>
</tr>
<tr>
<td>Mental and behavioural disorders</td>
<td>5.12 (3.91, 6.70)</td>
<td>&lt;.0001</td>
<td>5.71 (4.16, 7.84)</td>
<td>&lt;.0001</td>
<td>82.5</td>
<td>55757</td>
</tr>
<tr>
<td>Diseases of the nervous system</td>
<td>3.35 (2.55, 4.39)</td>
<td>&lt;.0001</td>
<td>3.25 (2.42, 4.35)</td>
<td>&lt;.0001</td>
<td>69.2</td>
<td>39976</td>
</tr>
<tr>
<td>All other conditions</td>
<td>3.94 (2.88, 5.37)</td>
<td>&lt;.0001</td>
<td>3.42 (2.43, 4.82)</td>
<td>&lt;.0001</td>
<td>70.8</td>
<td>33169</td>
</tr>
<tr>
<td>Depression/mood affective disorders (excluding postnatal depression)</td>
<td>6.55 (4.51, 9.53)</td>
<td>&lt;.0001</td>
<td>6.71 (4.44, 10.14)</td>
<td>&lt;.0001</td>
<td>85.1</td>
<td>32724</td>
</tr>
<tr>
<td>Other diseases of the musculoskeletal system and connective tissue</td>
<td>4.38 (3.20, 6.00)</td>
<td>&lt;.0001</td>
<td>3.16 (2.25, 4.44)</td>
<td>&lt;.0001</td>
<td>68.3</td>
<td>31452</td>
</tr>
<tr>
<td>Heart diseases</td>
<td>5.22 (3.67, 7.44)</td>
<td>&lt;.0001</td>
<td>4.21 (2.77, 6.40)</td>
<td>&lt;.0001</td>
<td>76.2</td>
<td>31363</td>
</tr>
<tr>
<td>Injury/accident</td>
<td>3.00 (2.21, 4.07)</td>
<td>&lt;.0001</td>
<td>3.71 (2.63, 5.23)</td>
<td>&lt;.0001</td>
<td>73.0</td>
<td>30311</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.99 (2.21, 4.04)</td>
<td>&lt;.0001</td>
<td>2.52 (1.85, 3.43)</td>
<td>&lt;.0001</td>
<td>60.3</td>
<td>27004</td>
</tr>
<tr>
<td>Hypertension (high blood pressure)</td>
<td>1.86 (1.51, 2.30)</td>
<td>&lt;.0001</td>
<td>1.29 (1.03, 1.62)</td>
<td>&lt;.0261</td>
<td>22.7</td>
<td>19546</td>
</tr>
<tr>
<td>Neoplasms (tumours/cancers)</td>
<td>4.78 (3.05, 7.49)</td>
<td>&lt;.0001</td>
<td>3.66 (2.19, 6.11)</td>
<td>&lt;.0001</td>
<td>72.7</td>
<td>16525</td>
</tr>
<tr>
<td>Diseases of the respiratory system</td>
<td>6.37 (3.88, 10.5)</td>
<td>&lt;.0001</td>
<td>3.68 (2.07, 6.54)</td>
<td>&lt;.0001</td>
<td>72.8</td>
<td>16014</td>
</tr>
</tbody>
</table>
National annual impact of persons not in the labour force due to ill health (adjusted for age, sex and education) for the Australian population aged 45-64 years, 2009

<table>
<thead>
<tr>
<th></th>
<th>Income</th>
<th>Transfer Payments</th>
<th>Taxation Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not in labour force due to ill health</td>
<td>17,989,175,000</td>
<td>1,468,007,000</td>
<td>2,052,384,000</td>
</tr>
</tbody>
</table>

Note: Based on the differences between persons not in the labour force due to ill health and the weighted average of persons employed full time and part time.
Geometric means of weekly income, transfer payments and tax liability by labour force status for the Australian population aged 45-64 years, 2009

<table>
<thead>
<tr>
<th>Labour force status</th>
<th>Weekly income</th>
<th>Weekly transfer income</th>
<th>Weekly tax liability (includes Medicare levy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed full-time</td>
<td>1167.0</td>
<td>0.2</td>
<td>166.3</td>
</tr>
<tr>
<td>Employed part-time</td>
<td>482.9</td>
<td>0.9</td>
<td>8.9</td>
</tr>
<tr>
<td>Not in labour force due to ill health</td>
<td>217.8</td>
<td>74.2</td>
<td>0.0</td>
</tr>
</tbody>
</table>
### Estimate of assets in 2009 and at age 65 and income from savings at age 65

<table>
<thead>
<tr>
<th>Sex, Labour force status and long term health condition of 45-64 year olds</th>
<th>Current</th>
<th>At age 65</th>
<th>Income from savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Super</td>
<td>Other financial assets</td>
<td>Super</td>
</tr>
<tr>
<td>Male</td>
<td>Employed full-time (no condition)</td>
<td>100,700</td>
<td>206,500</td>
</tr>
<tr>
<td></td>
<td>Employed part-time (long term condition)</td>
<td>80,800</td>
<td>203,000</td>
</tr>
<tr>
<td></td>
<td>Not in labour force (long term health condition)</td>
<td>65,000</td>
<td>62,400</td>
</tr>
<tr>
<td>Female</td>
<td>Employed full-time (no condition)</td>
<td>62,500</td>
<td>175,100</td>
</tr>
<tr>
<td></td>
<td>Employed part-time (long term condition)</td>
<td>41,300</td>
<td>187,500</td>
</tr>
<tr>
<td></td>
<td>Not in labour force (long term health condition)</td>
<td>29,100</td>
<td>129,500</td>
</tr>
</tbody>
</table>

Source: Draft output from Health&WealthMOD simulation (not for quotation), June 2009
Total impact of ill health

• Exiting the workforce as a result of ill health is costly to both individuals and governments. The amount of lost income was significant, adding to the hardship experienced due to illness itself. Investment in improvements in health is potentially an important way of improving national living standards.
Family Medicine Research Centre

**KNOWLEDGE**

**PREFERENCES**
- the patient
- the community

**DECISIONS/EVAL**
- Cost effectiveness
- Equity analysis
- Labour force
- HSR, Health Systems
- Policy
Family Medicine Research Centre - FMRC

*Current research and future direction*

Helena Britt    Graeme Miller    Joan Henderson
The FMRC is a University of Sydney Research Centre, academically attached to the School of Public Health

- A not-for-profit organisation — all funding is self-generated
- Established in 1992

Within the FMRC:

The Australian General Practice Statistics & Classification Centre (AGPSCC)

- A collaborating Centre of the Australian Institute of Health and Welfare and the University of Sydney
- Purpose – to objectively and independently collect standardised data about primary care
Currently –

Classification and terminologies

- distributor of the International Classification of Primary Care – Version 2 (ICPC-2) in Australia
- developed and maintain an interface terminology based on ICPC-2 called ICPC-2 PLUS – used by approx. 2,000 GPs around Australia, in community health and RFDS.
- members of the Wonca International Classification Committee (WICC)
- members of the GP/FP Special Interest Group of the IHTSDO – the SNOMED CT Standards Development Organisation
Classification and terminologies (cont…) 

SNOMED-CT recently adopted as the Standard Clinical Terminology for Australian Health System

- current contract with NEHTA – requirements and project plan for a GP subset of SNOMED CT for use in Australian GP desktop electronic medical records.

- prepare associated maps from the GP SNOMED subset to IDC-10-AM and ICPC-2

- 2nd contract with NEHTA to map the Australian Medicines Terminology to the WHO Anatomical and Therapeutic Chemical (ATC) Classification, and for its ongoing maintenance.
Currently –

General practice research

Why study general practice?

- About 85% of Australians visit a GP at least once each year
- On average – 5.2 consultations per person
- There are 22,564 GPs in Australia (currently a shortage)
- GPs are gatekeepers to accessing care in the health system
- GP-patient consultations currently generate $7 billion per year in primary and secondary costs to government

Sydney School of Public Health
The University of Sydney

Family Medicine Research Centre
BEACH - Bettering the Evaluation and Care of Health

- National cross-sectional survey
- Began April 1998, now in its 12th year
- Each year - random sample of about 1,000 GPs (ever changing)
- Each GP records details of 100 patient encounters on structured paper based forms + a GP characteristic questionnaire
- Over 1.1 million GP-patient encounters

Sydney School of Public Health
The University of Sydney
Family Medicine Research Centre
The BEACH research team

Prof Helena Britt  BA, PhD – Director
Prof Graeme Miller  MB BS, PhD, FRACGP – Medical Director
Dr Joan Henderson  BAppSc (HIM) (Hons1), PhD – Senior Research Fellow

- **Data collection**
  - Janice Charles  BA, MSc (Med) - Operations manager
  - Clare Bayram  BAppSc (HIM) (Hons) (current PhD student) – SAND Co-ordinator
    - Recruitment staff (led by Errol Henderson)
    - Data entry staff (trained by Clare Bayram/Salma Fahradin)

- **Data analysts**
  - Lisa Valenti  BEc (Statistics), M Med Stats
  - Ying Pan  B.Med, MCH
  - Christopher Harrison  BPsysch (Hons), MSocHealth
  - Salma Fahridin  BAppSc (HIM) MHSc (Clin.Data Mgt)

- **Coding and classification**
  - Julie O’Halloran  BAppSc (HIM) (Hons) (current PhD student)

- **Admin support** - Gervaise Woods, Denise Barratt

- **Computer technical:** Tim Chambers

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The University of Sydney
Family Medicine Research Centre
BEACH collects ...

- **GP characteristics**
  - age, sex, OTD, years in GP, FRACGP, practice size and location (RRMA, SEIFA), etc

- **Encounter characteristics**
  - When, where, item no, problems managed and how – medications/treatments/refs/tests for each

- **Patient characteristics**
  - age, sex, new to practice, ATSI, NESB, HCC/VA, location of residence, reasons for visit

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Observed (BEACH) vs expected (MBS) patient age distribution – Australia

Age distribution of patients

2007-08

Per cent

0.0  5.0  10.0  15.0  20.0  25.0  30.0

<1 1-4 5-14 15-24 25-44 45-64 65-74 75+

BEACH encounters
MBS A1 Services

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Family Medicine Research Centre
Supplementary Analysis of Nominated Data

- Sub-studies involving 100+ GPs in each
- Questions asked about the patient
- Problems surveyed may not have been managed at the encounter
- Semi-longitudinal view.
- Sample sizes range from 3,000-10,000
Observed (SAND) vs expected (MBS) patient age distribution – Australia

$n = 6,015$

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The University of Sydney
Family Medicine Research Centre
What topics are reported?

- Methodology, data quality, clinical classification
- GP workforce, behaviour and education issues
- Presentation and management in general practice for public health areas of interest
  - smoking
  - alcohol use
  - obesity
  - illicit drug use
  - sexual health
  - men’s/women’s health
  - child/adolescent health
  - Indigenous health
  - HCC holders
  - NESB patients
  - RACF patients
  - DVA patients
  - patient access to care
  - specific morbidities
What topics are reported?

- National Health Priority Areas – asthma, cancer, CVD, diabetes, injury and mental health
- Adverse drug events
- Prevalence, incidence and multi-morbidity
- Chronic illnesses and conditions
- Work related problems
- Morbidity associated with pathology and imaging orders
Future –
Classification and terminologies

- continue with distribution and support of ICPC-2 in Australia
- continue with development and maintenance of ICPC-2 PLUS
- continue to assist with terminology standards development both nationally (NEHTA) and internationally (IHTSDO)
- be involved in the development of Version 3 of the ICPC (ICPC-3)
Future –

**General practice research**

**BEACH** … Cross-sectional study will continue – ongoing development

**Long-BEACH** … Longitudinal study enrolling GPs and patients to collect same data elements for individuals over time – link other data sources – observe health outcomes rather than just processes

Continue collaborative work with other research organisations where **BEACH** augments their work

Continue to support student research – PhD, Masters and Honours candidates.
Future Directions

KIDS

Knowledge Interaction Decision Support
KIDS

NHMRC CRE application

Glenn Salkeld
Deborah Schofield
Lyndal Trevena
Megan Passey
Lucie Rychetnik
Helena Britt
Richard Percival
‘Key concepts’

<table>
<thead>
<tr>
<th>Diabetes Prevention</th>
<th>Example only</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scores</strong></td>
<td></td>
</tr>
<tr>
<td>Usual Care</td>
<td>0.192</td>
</tr>
<tr>
<td>Medication</td>
<td>0.400</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>0.365</td>
</tr>
<tr>
<td>Lifestyle + Medication</td>
<td>0.502</td>
</tr>
</tbody>
</table>

| **Weightings**      |              |
| Avoid Early Death   | 0.200        |
| Quality of Life     | 0.200        |
| Equity              | 0.200        |
| Economic Impact     | 0.200        |
| Cost Effectiveness  | 0.200        |

| **Ratings**         |              |
| Usual Care          | 0.182        |
| Medication          | 0.348        |
|                      | 0.671        |
|                      | 0.276        |
|                      | 0.000        |
|                      | 0.000        |
| Lifestyle            | 0.500        |
|                      | 0.434        |
|                      | 0.142        |
|                      | 0.142        |
|                      | 0.608        |
| Lifestyle + Medication | 0.782      |
|                      | 0.387        |
|                      | 0.395        |
|                      | 0.490        |
|                      | 0.458        |
Future Directions

The next phase of EBM – values-based decision making

Healthbook Sydney

Cost effectiveness analysis for better resource allocation

Equity analysis for fairer distribution of resources

Labour Force analysis – planning for the supply side

Primary Care – electronic data capture