The Economic Consequences of Diabetes: More than just a health issue

Dr Hannah Carter

ADEA-QLD Conference
21 April 2018
Overview

• The Cost of Illness (COI) framework
  – Direct costs of diabetes
  – Indirect costs of diabetes

• Value based health care
  – Cost-effectiveness analyses
  – Valuing economic benefits of diabetes interventions
COST OF ILLNESS
What is meant by ‘Cost of Illness’

• Purpose is to estimate the economic burden of illness to society as a whole
• COI was the first economic evaluation technique applied to the health care setting
• Dates back to a 1951 WHO document
• COI Literature has since expanded rapidly
  – 191 new studies during the 1990’s
  – 732 between 2000-2008
Costs of Illness

Direct Costs

Medical costs
- Hosp admissions
- ED presentations
- Outpatient appt.'s
- Medical procedures
- Pharmaceuticals

Non-medical costs
- Transportation
- Supported accommodation
- Special food

Indirect Costs

Morbidity Costs
- Absenteeism
- Early retirement

Mortality Costs
- Lost working years

Government subsidies
Why do we want to know about the cost of illness?

- **Macroeconomic level** – policy makers look for information on how society’s resources are distributed

- **Microeconomic level** – researchers use COI data in estimating the cost effectiveness of new innovations
The proportion of Australia’s wealth (GDP) that is spent on health care:

10.3% ($170 Bn)

Education
Sport
Parks
Roads
Airports
Industry
Defence
Welfare
Population Change

In 2002: > five people of working age to support every person aged over 65. By 2042, only 2.5 people of working age supporting each person aged over 65.
Direct costs of Diabetes

The cost of diabetes in adults in Australia

Crystal Man Ying Lee\textsuperscript{a,*}, Ruth Colagiuri\textsuperscript{a}, Dianna J. Magliano\textsuperscript{b}, Adrian J. Cameron\textsuperscript{c}, Jonathan Shaw\textsuperscript{b}, Paul Zimmet\textsuperscript{b}, Stephen Colagiuri\textsuperscript{a}

\textsuperscript{a} The Boden Institute of Obesity, Nutrition, Exercise & Eating Disorders, University of Sydney, Sydney, Australia
\textsuperscript{b} BakerIDI Heart and Diabetes Institute, Melbourne, Australia
\textsuperscript{c} Deakin University, Melbourne, Australia
## Table 1 – Summary of items included for cost calculation.

<table>
<thead>
<tr>
<th>Costs</th>
<th>Items included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct healthcare</td>
<td>• Ambulatory service (visits to general practitioners, medical specialists and/or medical care professionals, hospital emergency admission)</td>
</tr>
<tr>
<td></td>
<td>• Hospitalization</td>
</tr>
<tr>
<td></td>
<td>• Prescription medication (other than those in the form of cream, eye drop, and inhaler) including insulin</td>
</tr>
<tr>
<td></td>
<td>• Aspirin (The only non-prescription medication included)</td>
</tr>
<tr>
<td></td>
<td>• Medically related consumables (Self blood glucose measuring meters and strips)</td>
</tr>
<tr>
<td>Direct non-healthcare</td>
<td>• Transport to hospital</td>
</tr>
<tr>
<td></td>
<td>• Supported accommodation (nursing home, hostel (low care facility), independent units)</td>
</tr>
<tr>
<td></td>
<td>• Home service (home help/support, Meals on Wheels) and day center</td>
</tr>
<tr>
<td></td>
<td>• Purchase of special food</td>
</tr>
<tr>
<td>Government subsidies</td>
<td>• Age pension</td>
</tr>
<tr>
<td></td>
<td>• Disability pension</td>
</tr>
<tr>
<td></td>
<td>• Veteran pension</td>
</tr>
<tr>
<td></td>
<td>• Mobility allowance</td>
</tr>
<tr>
<td></td>
<td>• Sickness allowance</td>
</tr>
<tr>
<td></td>
<td>• Unemployment benefit</td>
</tr>
</tbody>
</table>

**Total Costs**

- **$14.6 Billion in $2010**
- **$20.2 Billion in $2018**

Subtotal Costs:

- **$4.3 Billion**
- **$1.8 Billion**
- **$8.5 Billion**
Direct costs of Type 2 Diabetes

Direct costs of Diabetes

Average annual healthcare costs of Diabetes per person

<table>
<thead>
<tr>
<th></th>
<th>Type 1 diabetes</th>
<th>Type 2 diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No complications of diabetes</td>
<td>$3,468</td>
<td>$4,025</td>
</tr>
<tr>
<td>Microvascular complications only</td>
<td>$8,122</td>
<td>$7,025</td>
</tr>
<tr>
<td>Macrovascular complications only</td>
<td>$12,105</td>
<td>$9,055</td>
</tr>
<tr>
<td>Micro- and macrovascular complications</td>
<td>$16,698</td>
<td>$9,645</td>
</tr>
</tbody>
</table>


Indirect costs of Diabetes

• Morbidity costs
  – Absenteeism
  – Early retirement

• Mortality costs
  – Productive working years forgone

• *Personal financial impacts*
Morbidity costs of diabetes

The costs of diabetes among Australians aged 45–64 years from 2015 to 2030: projections of lost productive life years (PLYs), lost personal income, lost taxation revenue, extra welfare payments and lost gross domestic product from Health&WealthMOD2030

Deborah Schofield, Rupendra N Shrestha, Michelle M Cunich, Megan E Passey, Lennert Veerman, Robert Tanton, Simon J Kelly

Morbidity Costs of Diabetes

• In 2015:
  – 8,100 people were out of the labour force due to diabetes
  – $467 M in annual income lost
  – $311 M in additional welfare payments
  – $102 M in lost taxation revenue
  – $1.2 Billion in lost GDP, expected to increase to $2.9B per annum by 2030
Mortality costs of diabetes

• When modelled to the year 2030, premature mortality due to diabetes mellitus in the year 2003 accounted for:
  – 4,221 working years lost
  – $205 million in lost income (GDP)
  – $118,000 per death

• When combined with morbidity, total indirect costs of diabetes = $1.4 billion per annum

Personal financial impacts of diabetes

- 38% of 45 to 64 year olds with diabetes had retired early;
- 45 to 64 year olds who had retired early due to diabetes had weekly incomes 88% lower than their employed counterparts;
- Hazard ratio of falling into income poverty after developing type 2 diabetes is 1.9 in men (95% CI: 1.03 – 3.44);
- 27% of people with diabetes skipped care because of the cost.


VALUE BASED HEALTH CARE
At its core, value based healthcare is patient centred – it aims to maximise value for patients from a given pool of resources.

It asks us to adopt a new way of thinking – to question whether the value a service is providing to the community is acceptable relative to the resources required to deliver it.

High value care occurs when a large amount of health benefit is generated for a relatively small investment of resources.

Low-value care happens when we provide services that deliver very small or even zero health benefits.
Why is value based care important?

**Scarcity**

Human wants are unlimited

- New Technology
- Ageing & Lifestyle

**YET**

Resources are finite
Value based health care

- Microeconomic focus
- Estimates of the current costs associated with a health condition can inform cost-effectiveness analyses (CEA) of prevention or new treatment innovations
- Indirect costs are largely ignored in CEA
- Incorporating indirect costs can bolster arguments for investment in preventative and early intervention healthcare.
The proportion of Australia’s wealth (GDP) that is spent on health care:

Resources required for the innovation

Subsequent impact on health services

Costs for patients (or savings)

Political costs or benefits

new health services programme

Outcome: changes in health benefits

Outcome: changes in costs
Measuring costs

• Resource changes occur inside and outside of the health care system and both now and in the future.

**Practical issues to guide costing method**

A. Can they be measured with accuracy?

B. Can they be valued?

C. Are the costs large?

D. Will they be considered by the decision maker?
Are they ever valued?

Does anyone important care?

Should we include these changes to cost in our decision making?

What might they gain or lose by changing health services?

Should we include these changes to cost in our decision making?
Measuring benefits

• Aim is to measure benefits in a generic sense, so that these can be compared across multiple diseases and patient groups:
  
  – Life years gained
  
  – Quality Adjusted Life Years (QALYs) gained
<table>
<thead>
<tr>
<th>NEW SERVICE ‘X’</th>
<th>Baseline comparator</th>
<th>After the change</th>
<th>The Change</th>
<th>$\Delta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>100</td>
<td>300</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Health Benefits in QALYs</td>
<td>10</td>
<td>14</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

“A change to costs of $200 gives 4 QALYS

The cost per QALY gained is the change to costs divided by the change to health benefits, and is $50”.

This calculation is called an incremental cost-effectiveness ratio...or an ICER

$$\frac{\Delta C}{\Delta E} = \frac{200}{4} = 50$$
Are we willing to pay $50 per QALY?

Before

Lower Costs

Higher Costs

More QALYs

Less QALYs

$200

After

NEW SERVICE ‘X’
Are we willing to pay $50 per QALY?

NEW SERVICE ‘X’

$100 per QALY is the threshold for decision makers

This is more than $100 per QALY

This is only $50 per QALY?
What are we willing to pay for improved health?
INTERNATIONAL SURVEY ON WILLINGNESS-TO-PAY (WTP) FOR ONE ADDITIONAL QALY GAINED: WHAT IS THE THRESHOLD OF COST EFFECTIVENESS?

TAKERU SHIROIWA\textsuperscript{a,*}, YOON-KYOUNG SUNG\textsuperscript{b}, TAKASHI FUKUDA\textsuperscript{a}, HUI-CHU LANG\textsuperscript{a},
SANG-CHEOL BAE\textsuperscript{b} and KIICHIRO TSUTAN\textsuperscript{p}

<table>
<thead>
<tr>
<th>Country</th>
<th>Threshold (US)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>41,000</td>
</tr>
<tr>
<td>Taiwan</td>
<td>74,000</td>
</tr>
<tr>
<td>Korea</td>
<td>77,000</td>
</tr>
<tr>
<td>Australia</td>
<td>47,000</td>
</tr>
<tr>
<td>UK</td>
<td>36,000</td>
</tr>
<tr>
<td>US</td>
<td>62,000</td>
</tr>
</tbody>
</table>
### Some extracts of costs for quality adjusted life years (QALY) of competing treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cost/QALY (£ Aug 1990)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol testing and diet therapy only (all adults aged 40-69)</td>
<td>220</td>
</tr>
<tr>
<td>Neurosurgical intervention for head injury</td>
<td>240</td>
</tr>
<tr>
<td>Advice to stop smoking from general practitioner</td>
<td>270</td>
</tr>
<tr>
<td>Neurosurgical intervention for subarachnoid haemorrhage</td>
<td>490</td>
</tr>
<tr>
<td>Antihypertensive treatment to prevent stroke (ages 45-64)</td>
<td>940</td>
</tr>
<tr>
<td>Pacemaker implantation</td>
<td>1 100</td>
</tr>
<tr>
<td>Hip replacement</td>
<td>1 180</td>
</tr>
<tr>
<td>Valve replacement for aortic stenosis</td>
<td>1 140</td>
</tr>
<tr>
<td>Cholesterol testing and treatment</td>
<td>1 480</td>
</tr>
<tr>
<td>Coronary artery bypass graft (left main vessel disease, severe angina)</td>
<td>2 090</td>
</tr>
<tr>
<td>Kidney transplant</td>
<td>4 710</td>
</tr>
<tr>
<td>Breast cancer screening</td>
<td>5 780</td>
</tr>
<tr>
<td>Heart transplantation</td>
<td>7 840</td>
</tr>
<tr>
<td>Cholesterol testing and treatment (incrementally) of all adults aged 25-39</td>
<td>14 150</td>
</tr>
<tr>
<td>Home haemodialysis</td>
<td>17 260</td>
</tr>
<tr>
<td>Coronary artery bypass graft (one vessel disease, moderate angina)</td>
<td>18 830</td>
</tr>
<tr>
<td>Continuous ambulatory peritoneal dialysis</td>
<td>19 870</td>
</tr>
<tr>
<td>Hospital haemodialysis</td>
<td>21 970</td>
</tr>
<tr>
<td>Erythropoietin treatment for anaemia in dialysis patients (assuming 10% reduction in mortality)</td>
<td>54 380</td>
</tr>
<tr>
<td>Neurosurgical intervention for malignant intracranial tumours</td>
<td>107 780</td>
</tr>
<tr>
<td>Erythropoietin treatment for anaemia in dialysis patients (assuming no increase in survival)</td>
<td>126 290</td>
</tr>
</tbody>
</table>
What happens in Australia?

Cost-Effectiveness Analysis and the Consistency of Decision Making
Evidence from Pharmaceutical Reimbursement in Australia (1991 to 1996)

Bethan George, Anthony Harris and Andrew Mitchell

1 Centre for Policy and Practice, University of London School of Pharmacy, Tower Hamlets PCG and Barts’ and the London NHS Trust, London, UK
2 Health Economics Unit, Monash University, Clayton, Victoria, Australia
3 Pharmaceutical Evaluation Section, Department of Health and Aged Care, Canberra, Australia
PBAC decisions regarding reimbursement of pharmaceuticals

- Recommend at price
- Recommend at lower price
- Reject
To maximise health benefits, funding decisions should adopt a willingness to pay of $28,003 per QALY
The Cost-Effectiveness of Lifestyle Modification or Metformin in Preventing Type 2 Diabetes in Adults with Impaired Glucose Tolerance

William H. Herman, MD, MPH; Thomas J. Hoerger, PhD; Michael Brandle, MD, MS; Katherine Hicks, MS; Stephen Sorensen, PhD; Ping Zhang, PhD; Richard F. Hamman, MD, DrPH; Ronald T. Ackermann, MD, MPH; Michael M. Engelgau, MD, MS; and Robert E. Ratner, MD, for the Diabetes Prevention Program Research Group*

Direct medical costs only:
Lifestyle = $1,100 per QALY
Metformin = $31,300 per QALY

Direct medical and non-medical costs:
Lifestyle = $8,800 per QALY
Metformin = $29,900 per QALY
Indirect productivity gains associated with diabetes interventions

Passey et al. BMC Public Health 2012, 12:16
http://www.biomedcentral.com/1471-2458/12/16

RESEARCH ARTICLE

The impact of diabetes prevention on labour force participation and income of older Australians: an economic study

Megan E Passey¹, Rupendra N Shrestha², Melanie Y Bertram³, Deborah J Schofield², Theo Vos³, Emily J Callander²,⁴, Richard Percival⁵ and Simon J Kelly⁵
Increased number of person years in the labour force & the associated increased in total incomes over the ten years from 1993 to 2003 due to the interventions

<table>
<thead>
<tr>
<th>Age group in 2003</th>
<th>Over ten years</th>
<th>Total person years</th>
<th>Total incomes (2003 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>28</td>
<td>1,263,000</td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td>97</td>
<td>4,319,000</td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td>282</td>
<td>12,578,000</td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td>683</td>
<td>30,486,000</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>11</td>
<td>347,000</td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td>42</td>
<td>1,329,000</td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td>679</td>
<td>21,629,000</td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td>790</td>
<td>25,144,000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,612</td>
<td>97,095,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>11</td>
<td>347,000</td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td>42</td>
<td>1,329,000</td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td>816</td>
<td>25,983,000</td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td>890</td>
<td>28,334,000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3,038</td>
<td>113,049,000</td>
<td></td>
</tr>
</tbody>
</table>

**For pharmaceutical intervention using metformin**

**For lifestyle intervention**

Resources required for the innovation

Outcome: changes in health benefits

Subsequent impact on health services

Outcome: changes in costs

Costs for patients (or savings)

Political costs or benefits
In summary...

• Diabetes has a substantial cost, both to the health care system as well as indirectly through productivity and patient financial impacts

• An awareness of these costs can assist decision makes in allocating scarce resources in order to maximise health benefits to society