

**AusHSI**

*Bringing health  
innovation to life*

# 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

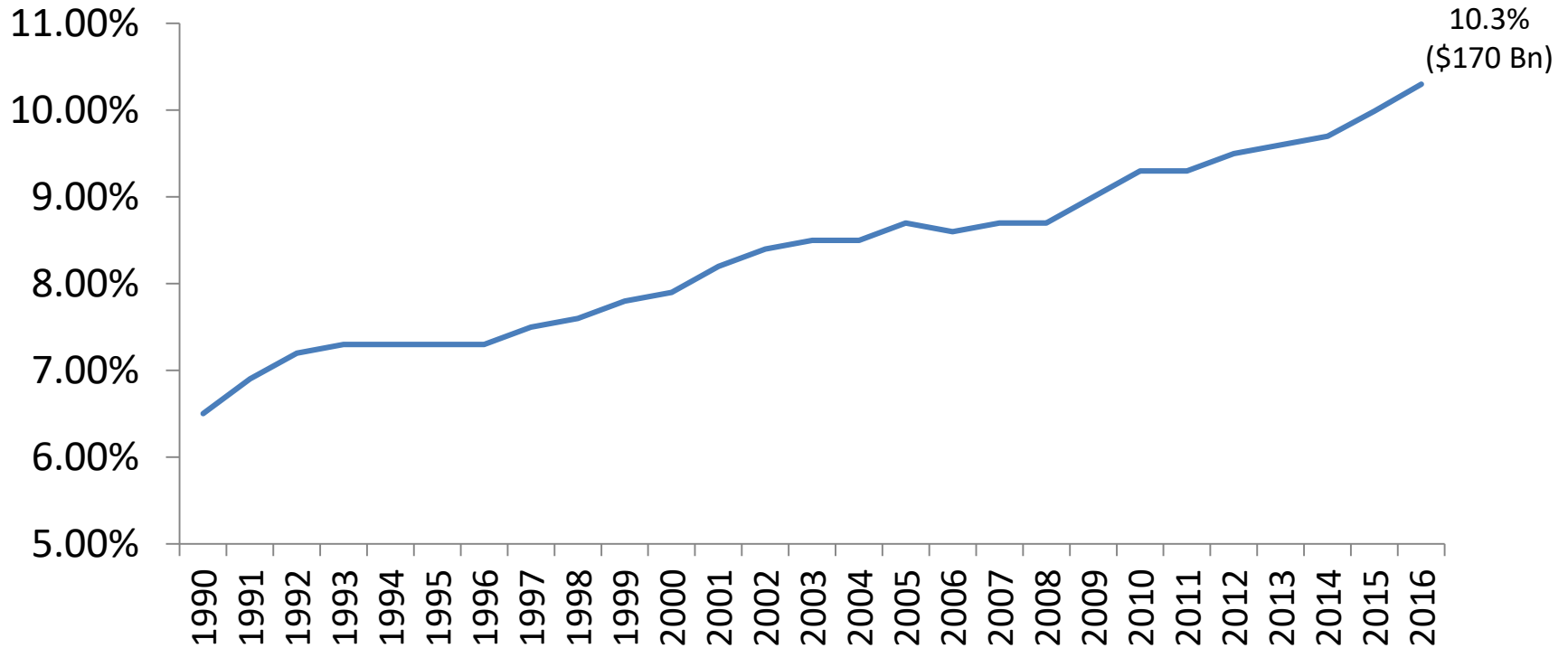
- Lost working years

Government subsidies

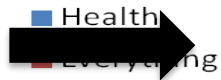
# Why do we want to know about the cost of illness?

- **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:



Source: <http://www.aihw.gov.au/health-expenditure/>



Educa  
Sport  
Parks  
Roads  
Airpor  
Indust  
Defence  
Welfare

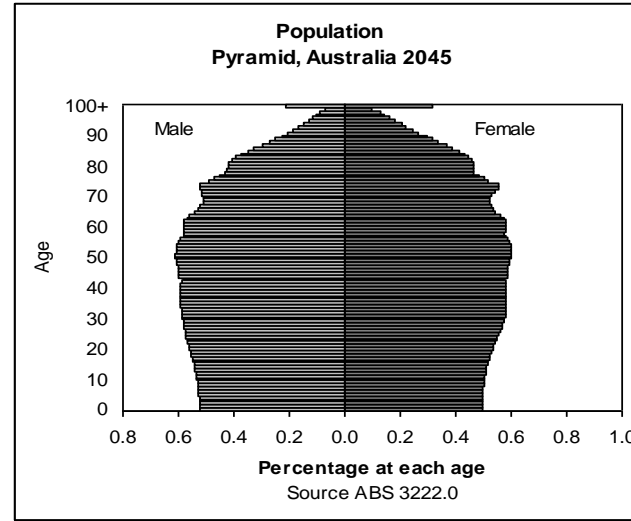
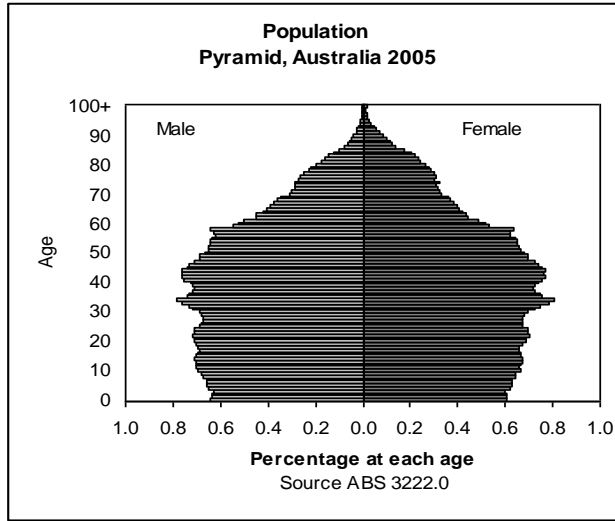




# Population Change

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.

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# Direct costs of Diabetes

DIABETES RESEARCH AND CLINICAL PRACTICE 99 (2013) 385–390



ELSEVIER

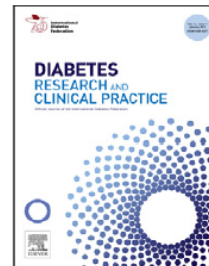
Contents available at Sciverse ScienceDirect

Diabetes Research  
and Clinical Practice

journal homepage: [www.elsevier.com/locate/diabres](http://www.elsevier.com/locate/diabres)



International  
Diabetes  
Federation



## The cost of diabetes in adults in Australia

Crystal Man Ying Lee<sup>a,\*</sup>, Ruth Colagiuri<sup>a</sup>, Dianna J. Magliano<sup>b</sup>, Adrian J. Cameron<sup>c</sup>,  
Jonathan Shaw<sup>b</sup>, Paul Zimmet<sup>b</sup>, Stephen Colagiuri<sup>a</sup>

<sup>a</sup> The Boden Institute of Obesity, Nutrition, Exercise & Eating Disorders, University of Sydney, Sydney, Australia

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<sup>c</sup> Deakin University, Melbourne, Australia

**Table 1 – Summary of items included for cost calculation.**

Costs	Items included
Direct healthcare	<ul style="list-style-type: none"><li>• Ambulatory service (visits to general practitioners, medical specialists and/or health care professionals, hospital emergency admission)</li><li>• Hospitalization</li><li>• Prescription medication (other than those in the form of cream, eye drop, and inhaler) including insulin</li><li>• Aspirin (The only non-prescription medication included)</li><li>• Medically related consumables (Self blood glucose measuring meters and strips)</li></ul>
Direct non-healthcare	<ul style="list-style-type: none"><li>• Transport to hospital</li><li>• Supported accommodation (nursing home, hostel (low care facility), independent units)</li><li>• Home service (home help/support, Meals on Wheels) and day center</li><li>• Purchase of special food</li></ul>
Government subsidies	<ul style="list-style-type: none"><li>• Age pension</li><li>• Disability pension</li><li>• Veteran pension</li><li>• Mobility allowance</li><li>• Sickness allowance</li><li>• Unemployment benefit</li></ul>

**\$14.6 Billion in \$2010**

**\$20.2 Billion in \$2018**

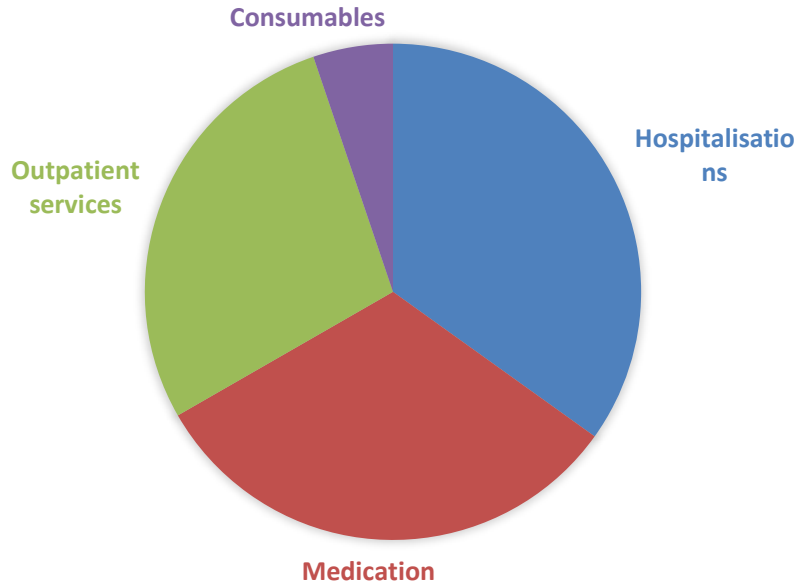
**\$4.3 Billion**

**\$1.8 Billion**

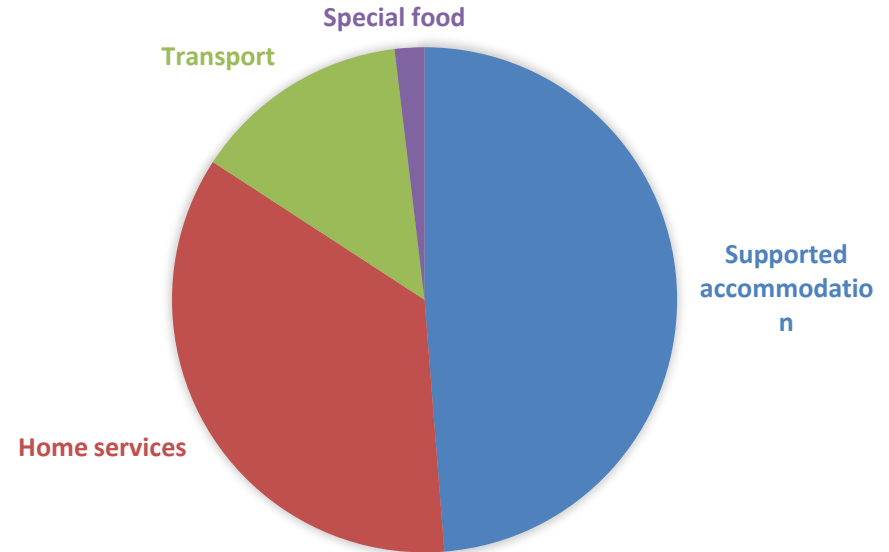
**\$8.5 Billion**

# Direct costs of Type 2 Diabetes

Medical costs



Non-medical costs



# Direct costs of Diabetes

Average annual healthcare costs of Diabetes per person

	Type 1 diabetes	Type 2 diabetes
No complications of diabetes	\$3,468	\$4,025
Microvascular complications only	\$8,122	\$7,025
Macrovascular complications only	\$12,105	\$9,055
Micro- and macrovascular complications	\$16,698	\$9,645

Colagiuri, S., Brnabic, A., Gomez, M., Fitzgerald, B., Buckley, A & Colagiuri, R. 2009. Diabco\$ Australia Type 1: assessing the burden of type 1 Diabetes in Australia. Canberra: Diabetes Australia.

Colagiuri, S., Colagiuri, R., Conway, B., Grainger, D. & Davey, P. 2003. Diabco\$ Australia: assessing the Burden of type 2 diabetes in Australia. Canberra: Diabetes Australia

# Indirect costs of Diabetes

- Morbidity costs
  - Absenteeism
  - Early retirement
- Mortality costs
  - Productive working years forgone
- *Personal financial impacts*

# Morbidity costs of diabetes

**BMJ Open** 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

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Deborah Schofield,<sup>1,2,3</sup> Rupendra N Shrestha,<sup>1</sup> Michelle M Cunich,<sup>1</sup> Megan E Passey,<sup>4</sup> Lennert Veerman,<sup>5</sup> Robert Tanton,<sup>6</sup> Simon J Kelly<sup>6</sup>

**To cite:** Schofield D, Shrestha RN, Cunich MM, *et al.* 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. *BMJ Open* 2017;**7**:e013158. doi:10.1136/bmjopen-2016-013158

# 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.

Schofield D, Cunich M, Shrestha R, Passey M, Veerman L, Callander E, Kelly S, Tanton R. (2014) 'The economic impact of diabetes through lost labour force participation on individuals and government: evidence from a microsimulation model' *BMC Public Health* 14(1).

Callander E, Schofield D. (2016) 'Type 2 diabetes mellitus and the risk of falling into poverty: an observational study', *Diabetes/Metabolism Research and Reviews* 32(6): 581-588.

Callander E, Corscadden L, Levesque, J. (2016) 'Out-of-pocket healthcare expenditure and chronic disease – do Australians forgo care due to the cost' *Australian Journal of Primary Health* (accepted 23/04/2016).

# **VALUE BASED HEALTH CARE**

# 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

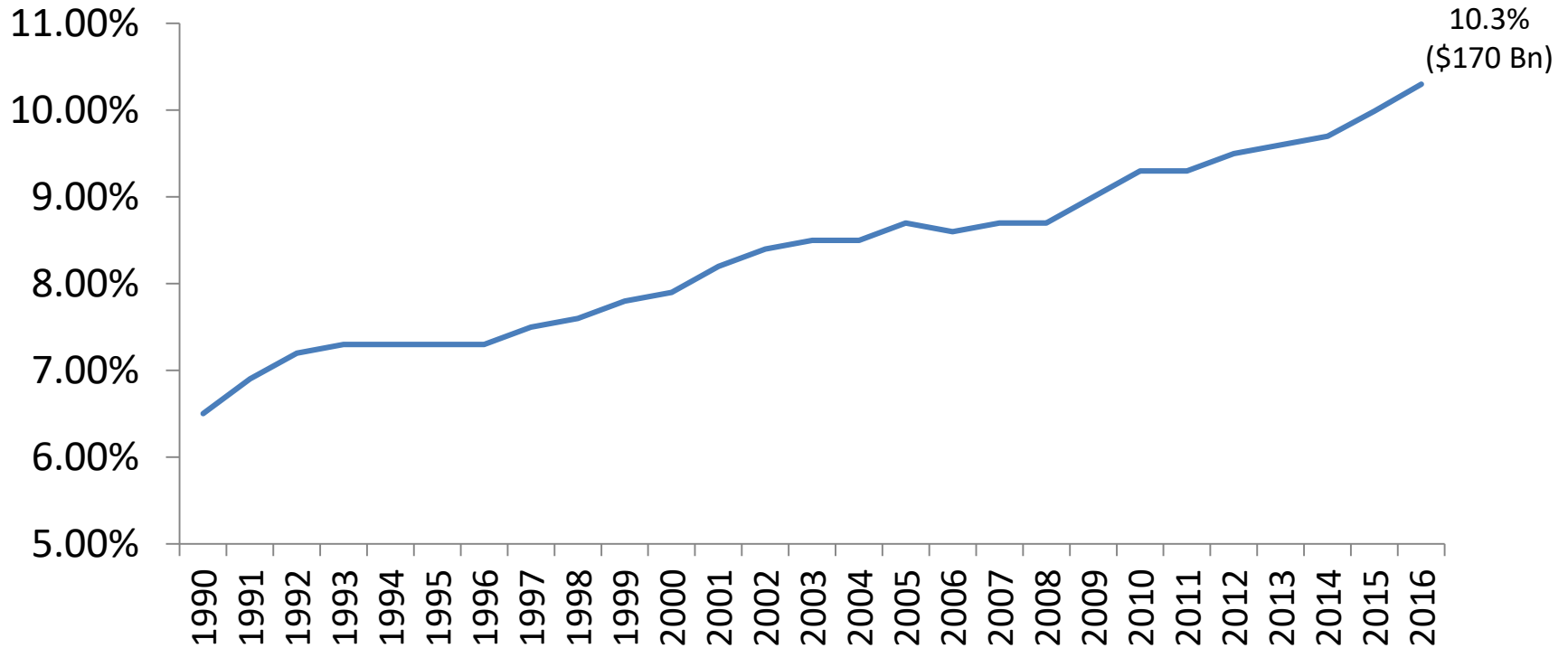
Resources are finite



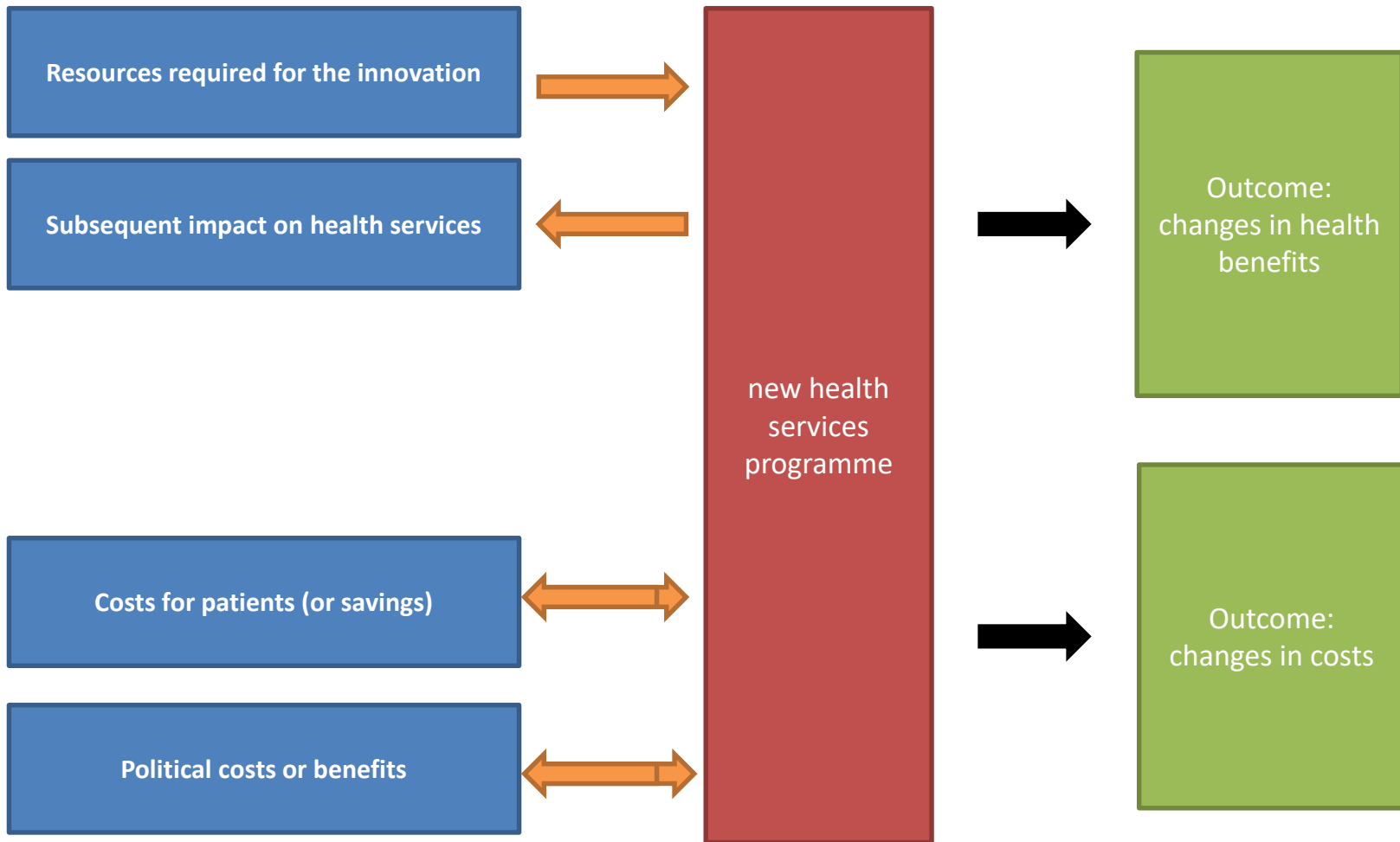
# Value based health care

- 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:



Source: <http://www.aihw.gov.au/health-expenditure/>





# 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?

## Costs for patients (or savings)

Are they ever valued?

Does anyone important care?

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



## Political costs or benefits

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

NEW SERVICE 'X'	Baseline comparator	After the change	The Change $\Delta$
Costs	100	300	200
Health Benefits in QALYs	10	14	4

*"A change to costs of \$200 gives 4 QALYS*

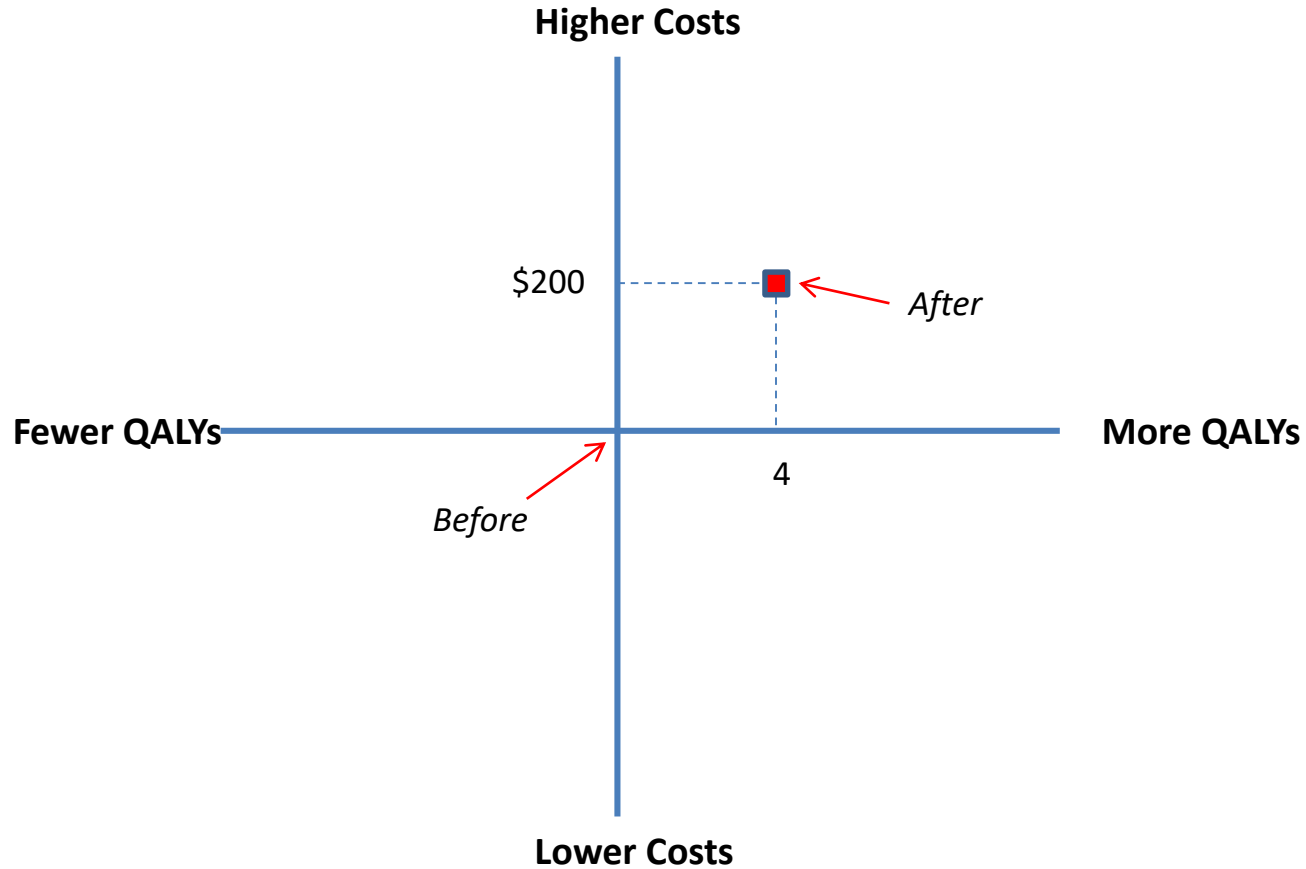
*The cost per QALY gained is the change to costs divided by the change to health benefits, and is \$50".*

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

$$\frac{\Delta C}{\Delta E} = \frac{200}{4} = 50$$

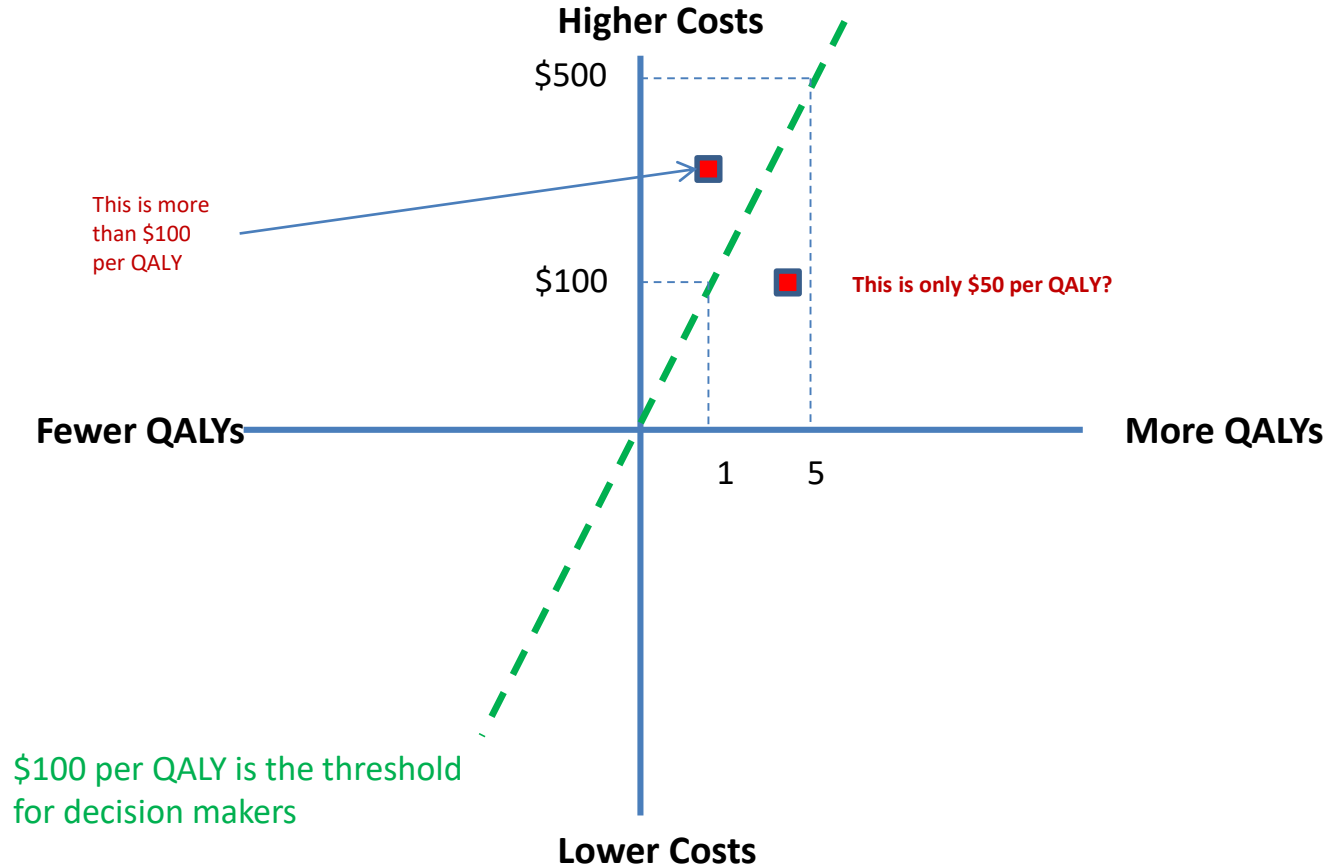
Are we willing to pay \$50 per QALY?

## NEW SERVICE 'X'



Are we willing to pay \$50 per QALY?

## NEW SERVICE 'X'









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<sup>a,\*</sup>, YOON-KYOUNG SUNG<sup>b</sup>, TAKASHI FUKUDA<sup>c</sup>, HUI-CHU LANG<sup>d</sup>,  
SANG-CHEOL BAE<sup>b</sup> and KIICHIRO TSUTANI<sup>a</sup>

Country	Threshold (US)
Japan	41,000
Taiwan	74,000
Korea	77,000
Australia	47,000
UK	36,000
US	62,000



Country	Threshold (US)	
Japan	41,000	
Taiwan	74,000	
Korea	77,000	
Australia	47,000	
UK	36,000	
US	62,000	



*Some extracts of costs for quality adjusted life years (QALY) of competing treatments<sup>7</sup>*

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

# What happens in Australia?

ORIGINAL RESEARCH ARTICLE

Pharmacoeconomics 2001; 19 (11): 1103-1109  
1170-7690/01/0011-1103/\$22.00/0

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

*Bethan George*<sup>1</sup>, *Anthony Harris*<sup>2</sup> and *Andrew Mitchell*<sup>3</sup>

- 1 Centre for Policy and Practice, University of London School of Pharmacy, Tower Hamlets PCC 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

Cost per life year  
gained

300000

250000

200000

150000

100000

50000

0

- Recommend at price
- Recommend at lower price
- Reject




1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

PBAC decisions regarding reimbursement of pharmaceuticals



ORIGINAL RESEARCH ARTICLE

# Estimating the Reference Incremental Cost-Effectiveness Ratio for the Australian Health System

Laura Catherine Edney<sup>1</sup>  · Hossein Haji Ali Afzali<sup>1</sup>  · Terence Chai Cheng<sup>2</sup>  ·  
Jonathan Karnon<sup>1</sup> 

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**

**Open Access**

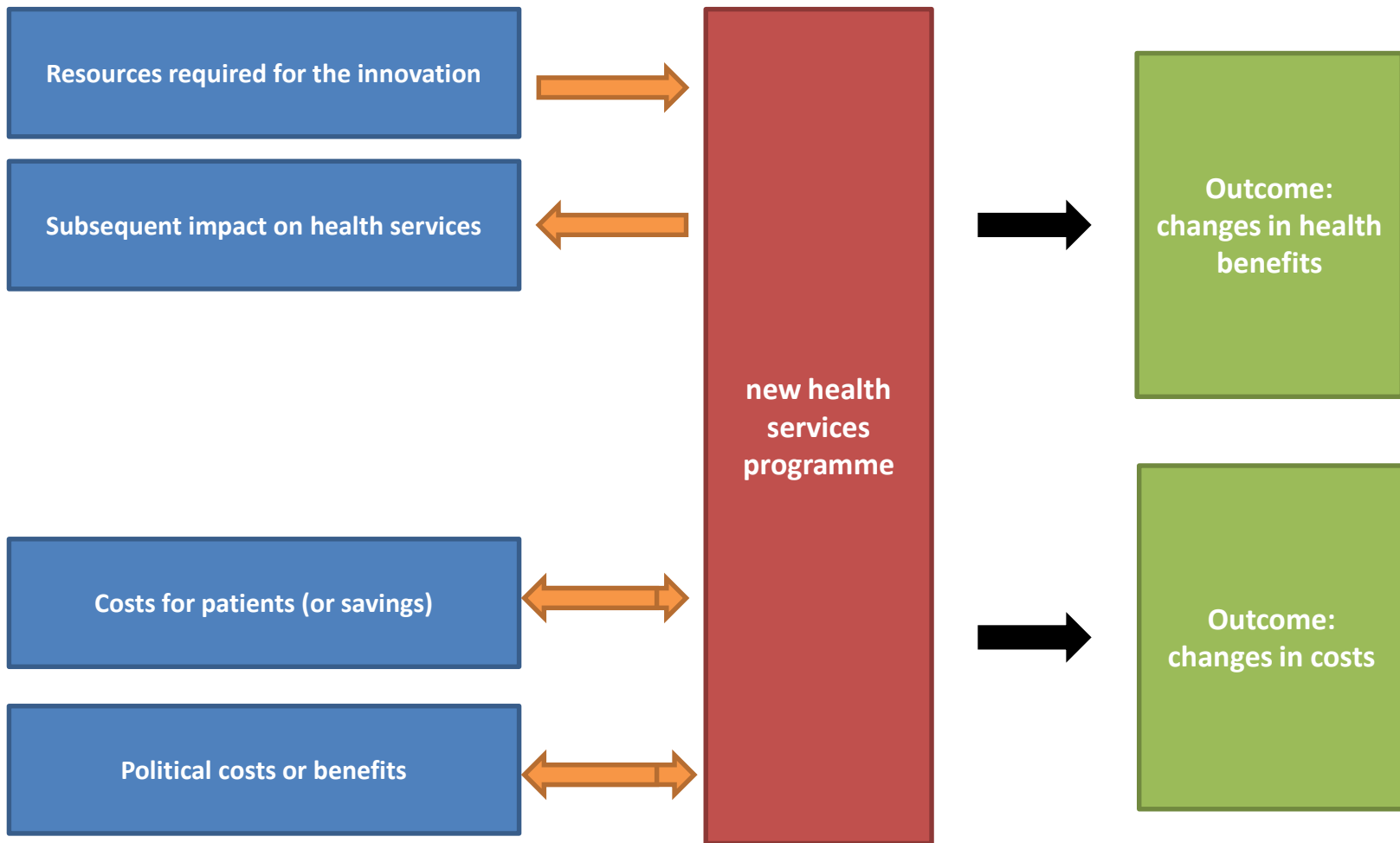
## The impact of diabetes prevention on labour force participation and income of older Australians: an economic study

Megan E Passey<sup>1\*</sup>, Rupendra N Shrestha<sup>2</sup>, Melanie Y Bertram<sup>3</sup>, Deborah J Schofield<sup>2,4</sup>, Theo Vos<sup>3</sup>, Emily J Callander<sup>2,4</sup>, Richard Percival<sup>5</sup> and Simon J Kelly<sup>5</sup>

## 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

	Age group in 2003	Over ten years	
		Total person years	Total incomes (2003 dollars)
<b><i>For pharmaceutical intervention using metformin</i></b>			
Male	45-49	28	1,263,000
	50-54	97	4,319,000
	55-59	282	12,578,000
	60-64	683	30,486,000
Female	45-49	11	347,000
	50-54	42	1,329,000
	55-59	679	21,629,000
	60-64	790	25,144,000
Total		2,612	<b>97,095,000</b>
<b><i>For lifestyle intervention</i></b>			
Male	45-49	43	1,896,000
	50-54	125	5,595,000
	55-59	358	15,967,000
	60-64	753	33,599,000
Female	45-49	11	347,000
	50-54	42	1,329,000
	55-59	816	25,983,000
	60-64	890	28,334,000
Total		3,038	<b>113,049,000</b>

REF: Passey M, Shrestha R, Bertram M, Schofield D, Vos T, Callander E, Percival R, Kelly S. 2012 'The impact of diabetes prevention on labour force participation and income of older Australians: an economic study' *BMC Public Health* 12(16).





# 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

# Aushsi

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