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AUSTRALIAN CENTRE
FOR
ECONOMIC RESEARCH
ON HEALTH

Economic Model System of Chronic Diseases in Australia: the Prototype

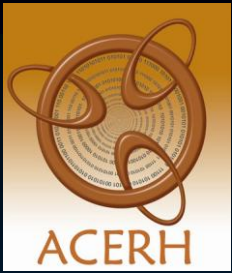
Dr Agnes Walker

A lecture in the Ma Yinchu Population Lecture Series
Peking University, Beijing
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Background and Aims

Chronic diseases in Australia (eg heart disease, cancer, diabetes)

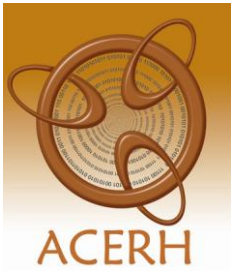
- affect around 80% of older Australians
- are the main causes of disability and premature death
- account for 70% of total health expenditures

The 5-year Project

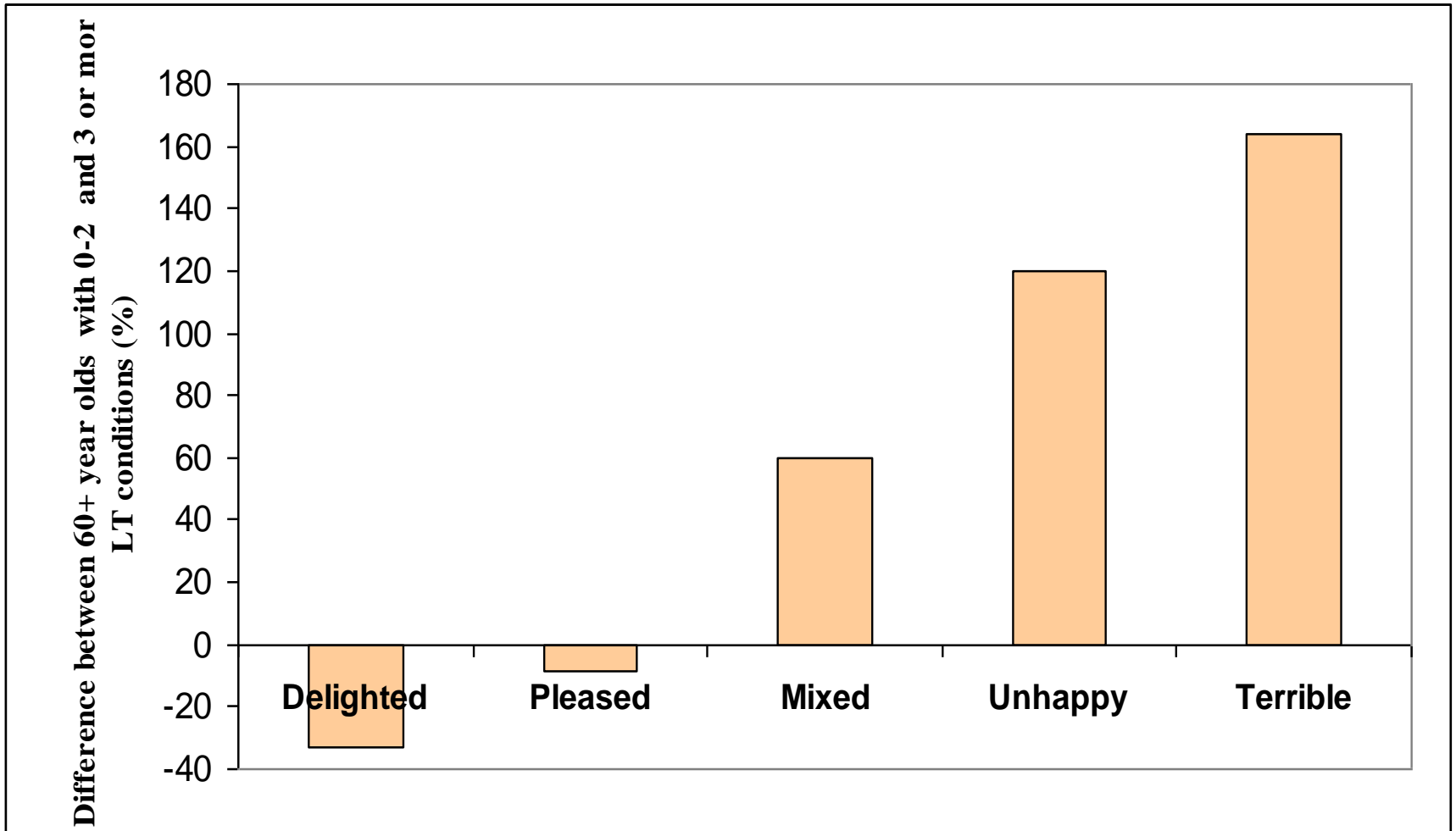
- concerns chronic diseases and comorbidities Australia-wide;
- is funded by the Australian Research Council;
- produces a microsimulation Umbrella model, linked to several disease specific progression models;
- Applications of model-system: assessing prevention/treatment options

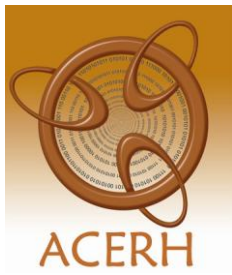
Aims of Presentation

- provide an overview of the prototype model-system
- describe data and methodology difficulties encountered
- present results of illustrative policy relevant application



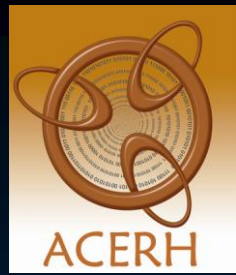
Poorer quality of life if 60+ year olds have 3 or more chronic illnesses



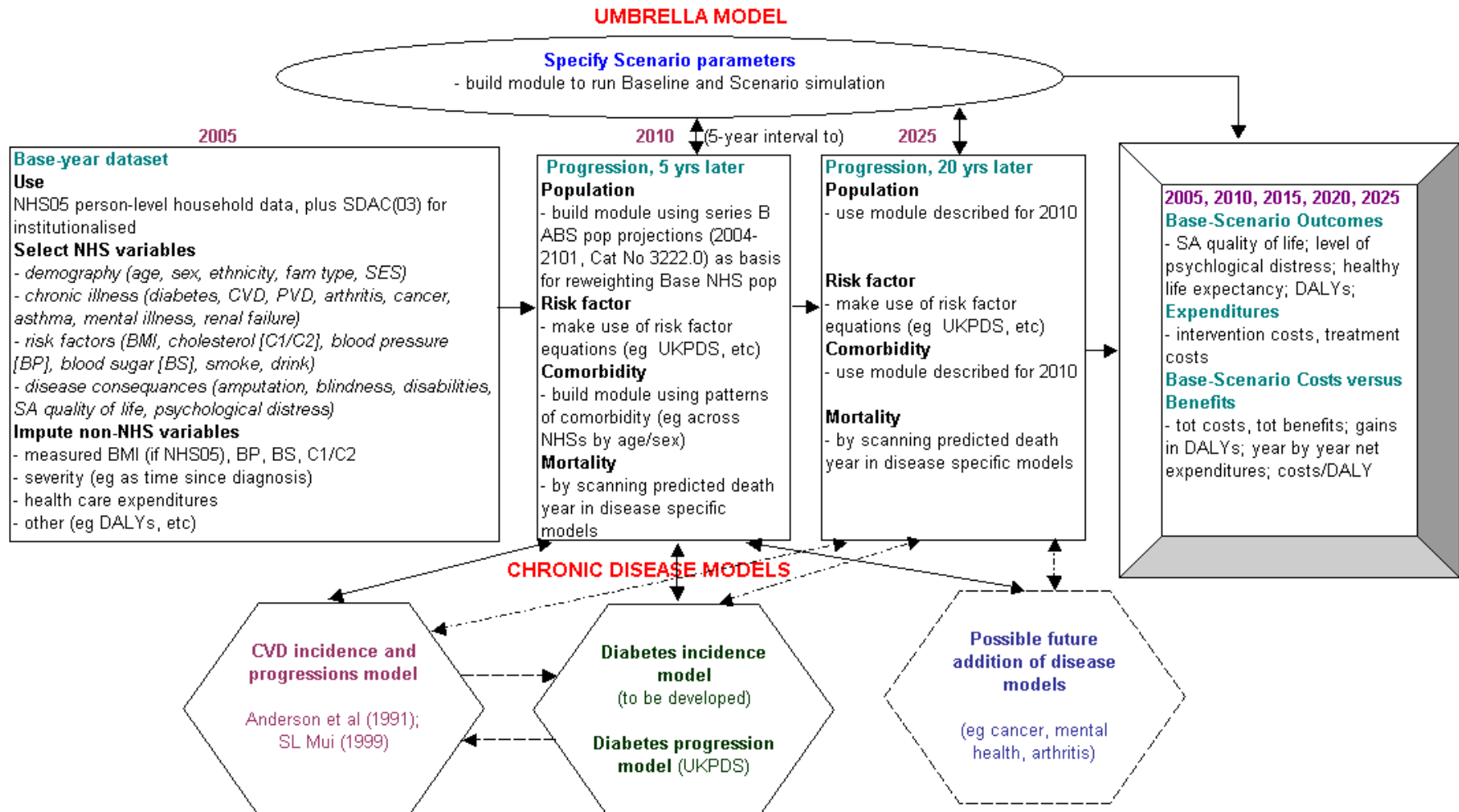


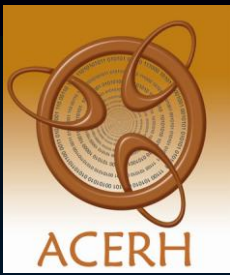
Higher per disease costs for those with multiple chronic diseases

Description	Average cost per person per year (\$)
<i>Single chronic illness</i>	
Cardiovascular disease (CVD)	4006
Cancer	2,478
Diabetes	1,289
<i>Multiple chronic illnesses</i>	
Cancer and CVD	8526
Diabetes and mental illness	2738
Cancer, CVD and mental illness	10,090

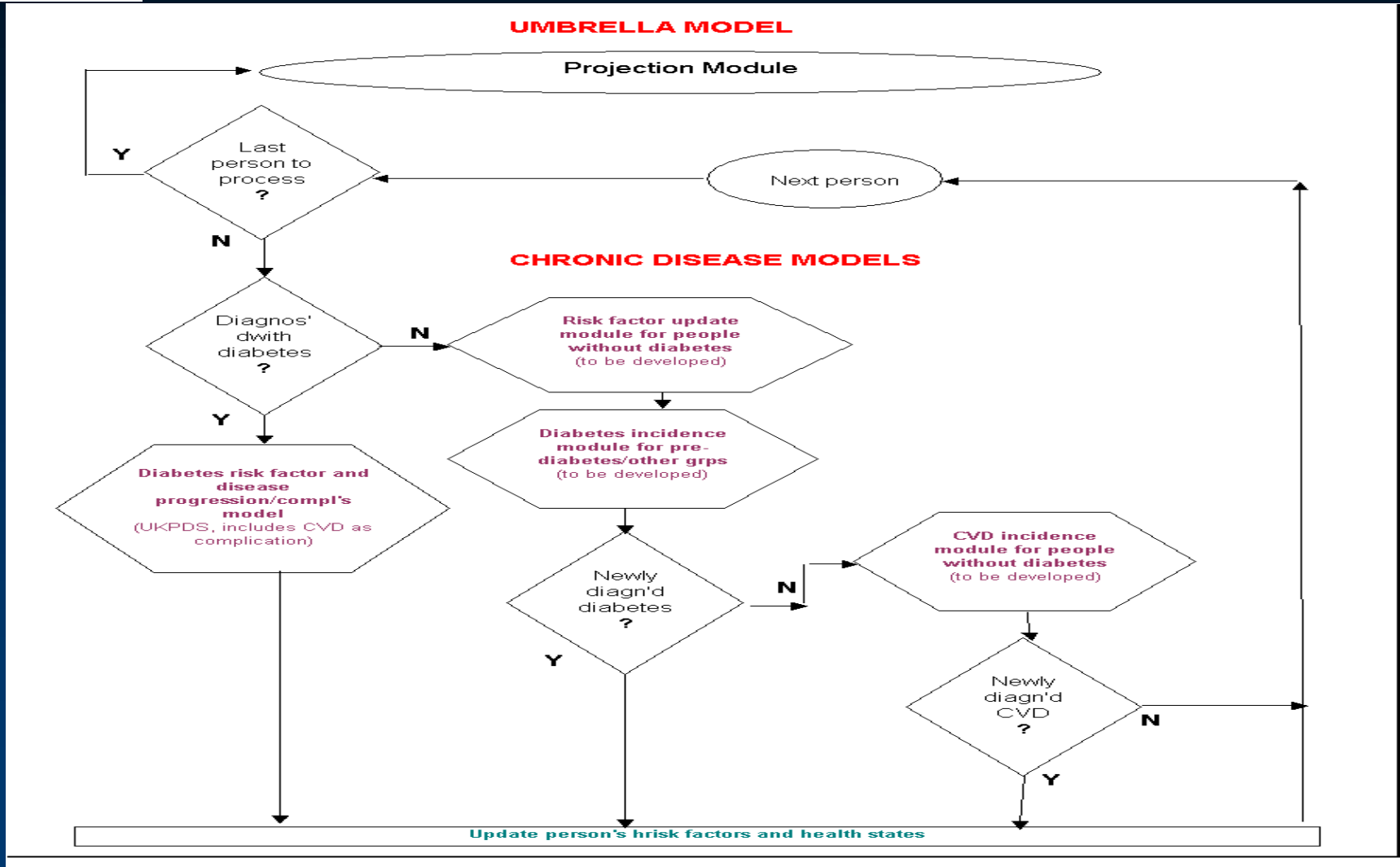


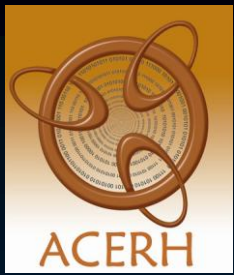
Overview of Chronic Disease Model System





Umbrella and disease-model linkages

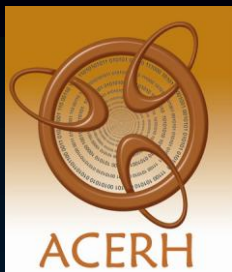




The data difficulties encountered

Data availability issues

- **initial plan: use US and UK longitudinal diabetes and CVD data, in the absence of such Australian data**
- **when applied to Umbrella model's basedata, the US and UK-based estimates for CVD and diabetes incidence rates and death rates were *well above* Australian aggregate benchmarks**
- **mid-way in the model-building phase *new Australian longitudinal CVD and diabetes data* became available (AusDiab 2000 and 2005)**
- **however: the 2005 wave of AusDiab was no longer nationally representative**
- **thus only unweighted AusDiab data could be used to indicate disease patterns (but not national aggregates)**

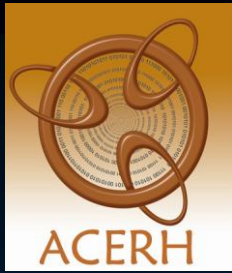


Data difficulties encountered

(continued)

Inconsistencies across Australian data sources

- *poor match* between self reported and measured AusDiab data and self reported cross sectional Bureau of Statistics (ABS) data
- diabetes prevalence estimates, from *same self-reported question* (25+year olds), were in 2000 and 2005 : 5.0% and 8.4% in AusDiab and 3.5% and 4.4% in ABS
- *measured* AusDiab prevalences (4.2% and 5.8%) better matched the self-reported ABS prevalences. For modelling we used the related AusDiab *diabetes incidence estimate of 0.48% per year*
- CVD non-fatal hospital events in AusDiab were even harder to match with benchmarks. For modelling CVD we used medically verified hospitalised *AusDiab heart and stroke incidence estimate of 0.43% per year*



Resolution in Prototype

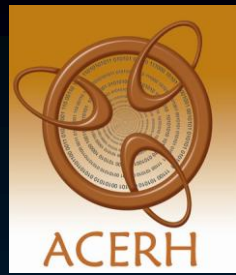
(diabetes/CVD)

We used unweighted AusDiab *measured* data to estimate the 5-year risks of new diabetes and non-fatal CVD events

We imported these risk equations into the Prototype

Next we used the Monte Carlo method to allocate new diabetes/CVD status to the Prototype's base population

Finally, we part-aligned the Prototype to aggregate Australian benchmarks (further alignments are in progress)



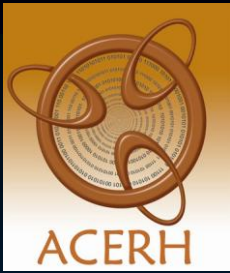
Methodological difficulties encountered

Accounting for deaths

CVD being the cause of death for some 500,000 persons per year created problems for our survey-based person-level model system

Reasons:

- ABS population projections for future years are for *alive* persons only
- the AusDiab equations predict *non-fatal* CVD events only
- removing 500,000 or so CVD dead a year reduced the ABS projected pop
- adjusting the weights of the 'healthy' to once again match the ABS age-sex population targets will impact on 'national representativeness'



Resolution in Prototype

(deaths)

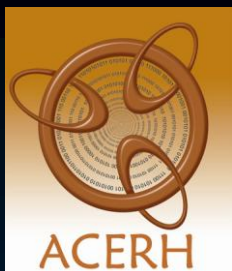
In absence of Australian data (due to very few AusDiab participants dying over the 5-years), to predict the risk of CVD deaths we embedded the US-data-based Anderson (1991) equation in the Prototype

We used the Monte Carlo method to allocate deaths to the Prototype's base population and aligned the mortality outcomes to match mortality trends published by the ABS.

Finally, we adjusted the weights of the 'healthy' population so that the Umbrella model's weighted population once again matched the ABS's projected population (within 5-year age-sex groups).

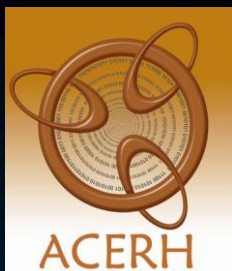
When projecting 5-years ahead, this methods gave acceptable results.

However, for projection periods of 10 years or more we will need to check whether national representativeness becomes severely compromised



Diabetes and CVD unit costs in Prototype (default)

	Cost per person A\$	per annum (1999-2000 dollars)
	<i>Non-fatal</i>	<i>Fatal</i>
Diabetes (no complications, cost per year)	1,289	
Coronary Vascular Disease_CVD (cost per hospital event)		
CHD (incl angina)	13,000	10,000
Stroke	13,000	10,000
Coronary Vascular Disease (per year, subsequent to hospital event)		
CHD (incl angina)	3,500	10,000
Stroke	3,500	10,000

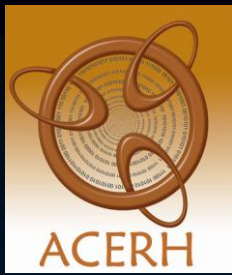


Preliminary validation of Prototype (15+ pop)

	Prototype	Benchmark	Source of benchmark
<i>Baseline characteristics, 2005 (15+ year olds)</i>			
15+ population	15,761,000	16,287,000	ABS 2005
Diagnosed type 2 diabetes, with or without CVD (No)	579,249	581,000#	AIHW 2008a
- treatment costs (million, A\$ in 2000)	1,595	1,664#	AIHW 2005
CVD, without diabetes (No)	627,000	-	
- treatment costs (million, A\$ in 2000)	4,514	4,547#	AIHW 2005

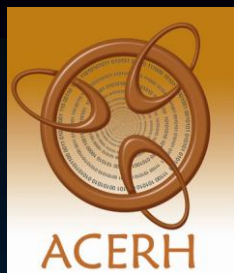
total population

SCENARIO1: 10% lower Body Mass Index, obese Australians* 2005 to 2010



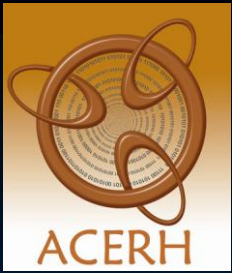
	Baseline: No Intervention	Scenario: 10% Lower BMI
Persons** (Number)		
Australians with diabetes only	951,706	894,480
difference Scenario -to- Baseline		- 57,226
Australians with diabetes+CVD event	50,749	43,387
difference Scenario -to- Baseline		- 7,362
Australians with non-fatal CVD event only	285,222	277,016
difference Scenario -to- Baseline		- 8,206
ALL PERSONS WITH DIABETES AND CVD	1,287,677	1,214,883
difference Scenario -to- Baseline		- 72,794
Expenditures (AU\$ million)		
Total expenditure_ <i>diabetes only</i>	4,816	4,629
difference Scenario -to- Baseline		- 187
Total expenditure_ <i>diabetes_ non-fatal CVD event</i>	1,128	981
difference Scenario -to- Baseline		- 147
Total expenditure_ <i>non-fatal CVD event only</i>	5,767	5,594
difference Scenario -to- Baseline		- 173
Expenditure_ <i>fatal CVD events</i>	1,317	1,317
difference Scenario -to- Baseline		0
TOTAL CVD plus DIABETES COSTS	13,028	12,521
difference Scenario -to- Baseline		- 507

* Body Mass Index (BMI) of 30 or more



SCENARIO3: scenario 1 plus 10% lower BP, sugar & cholesterol levels, obese Australians* 2005 to 2010

	<u>Scenario S1</u> 2010 population structure*	<u>Scenario S2</u> S1 with 10% lower weight for obese** adults	<u>Scenario S3</u> S2 with 10% lower blood pressure, sugar level, cholesterol
PERSONS IN 2010 <i>(numbers)</i>			
- Diabetes only	951,706	894,480	893,762
- Diabetes+CVD event	50,749	43,387	4,492
- CVD event only	285,222	277,016	274,437
All persons with diabetes and CVD	1,287,677	1,214,883	1,208,691
difference from S1		- 72,794	-78,968
5-YEAR EXPENDITURES <i>(AU\$ million)</i>			
- Diabetes only	4,816	4,629	4,630
- Diabetes+CVD event	1,128	981	934
- non-fatal CVD event only	5,767	5,594	5,532
- fatal CVD event only	1,317	1,317	1,303
Total CVD plus diabetes costs	13,028	12,521	12,399
difference from S1		- 507	-629



CONCLUSIONS

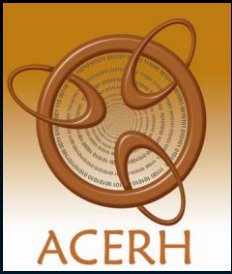
Main outcome so far: a workable Prototype which will be soon updated with forthcoming Australian data

Initial application of the Prototype demonstrated:

- the usefulness of studying chronic diseases a group, rather than on a disease by disease basis
- the technical feasibility of accounting for the complex processes through which individuals acquire several of such diseases as they age

Further research possibilities:

- simultaneously considering additional chronic diseases (eg arthritis)
- studying the work and financial implications of chronic disease prevention scenarios



Further information

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