Economic Model System of Chronic Diseases in Australia: the Prototype

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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

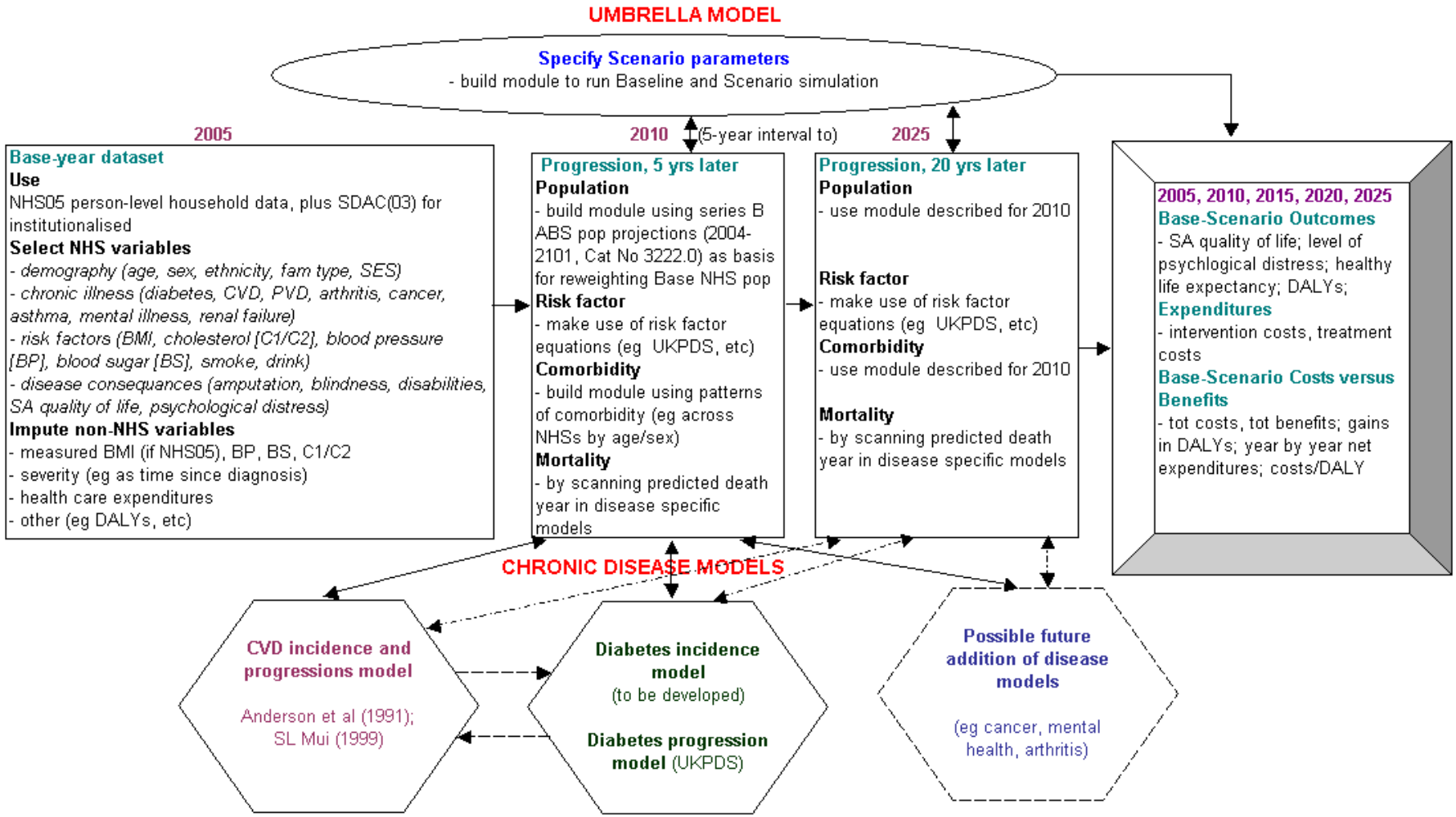
The 5-year Project

- 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

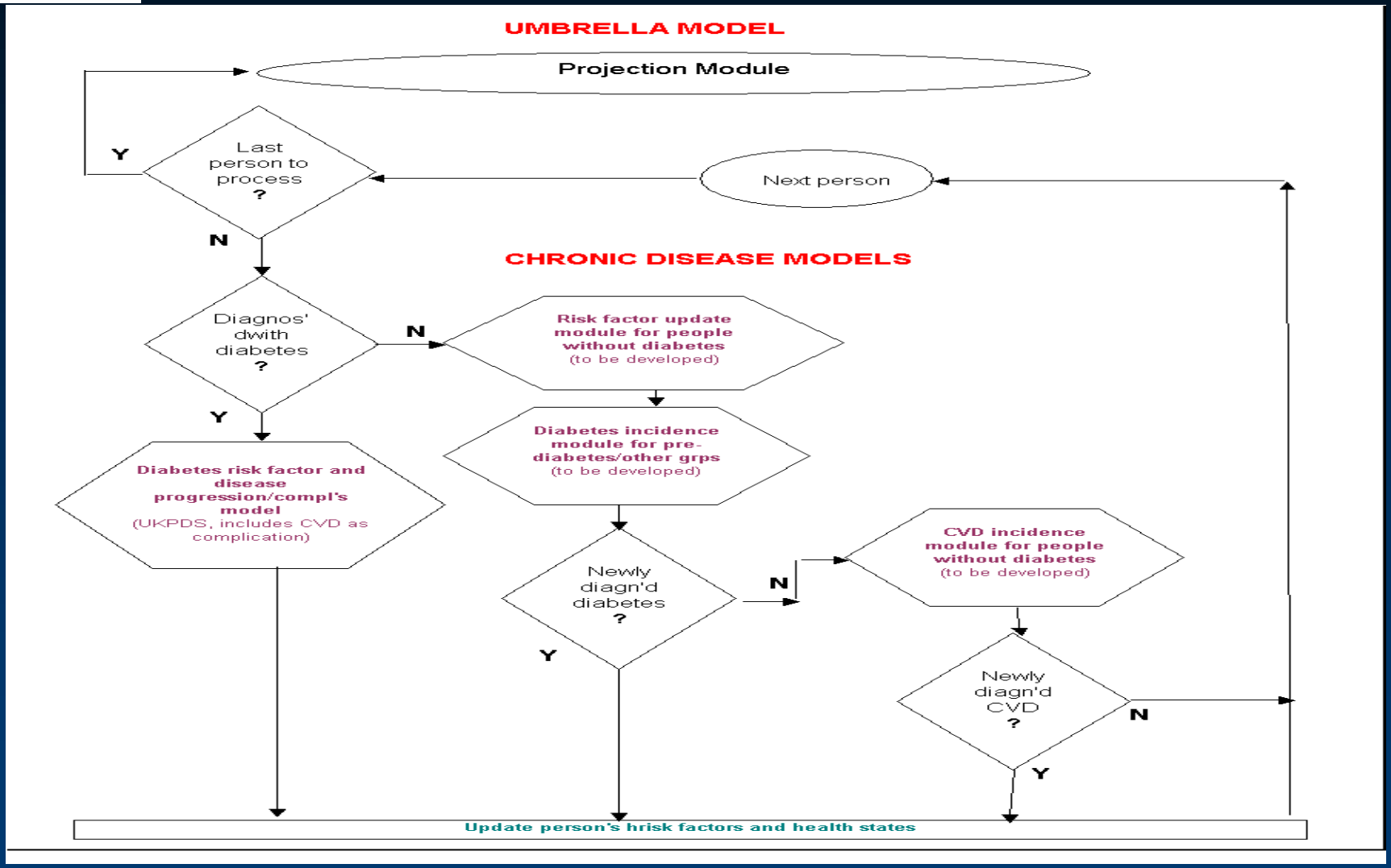
Aims of Presentation

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

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**
- **<u>diabetes</u> <u>prevalence estimates</u>, 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***
- **<u>CVD non-fatal hospital events</u> 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)
	Non-fatal	***Fatal***
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
Baseline characteristics, 2005 **(15+ year olds)**			
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

SCENARIO: 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_*diabetes only*	4,816	4,629
difference Scenario -to- Baseline		- 187
Total expenditure_*diabetes_non-fatal CVD event*	1,128	981
difference Scenario -to- Baseline		- 147
Total expenditure_*non-fatal CVD event only*	5,767	5,594
difference Scenario -to- Baseline		- 173
Expenditure_fatal CVD events	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

CONCLUSIONS

Main outcome so far: a workable Prototype which will be soon up-dated 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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