



Primary Care in an Ageing Society:

Building a Micro-simulation Model for Policy Purposes



THE UNIVERSITY
OF AUCKLAND

NEW ZEALAND

Te Whare Wānanga o Tāmaki Makaurau

Professor Peter Davis (Presenter) & Colleagues
Sociology and COMPASS (www.compass.auckland.ac.nz)
University of Auckland, New Zealand



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➤ Concept

➤ Implementation

➤ Validation

➤ Scenario projection

❑ Concept

❑ Implementation

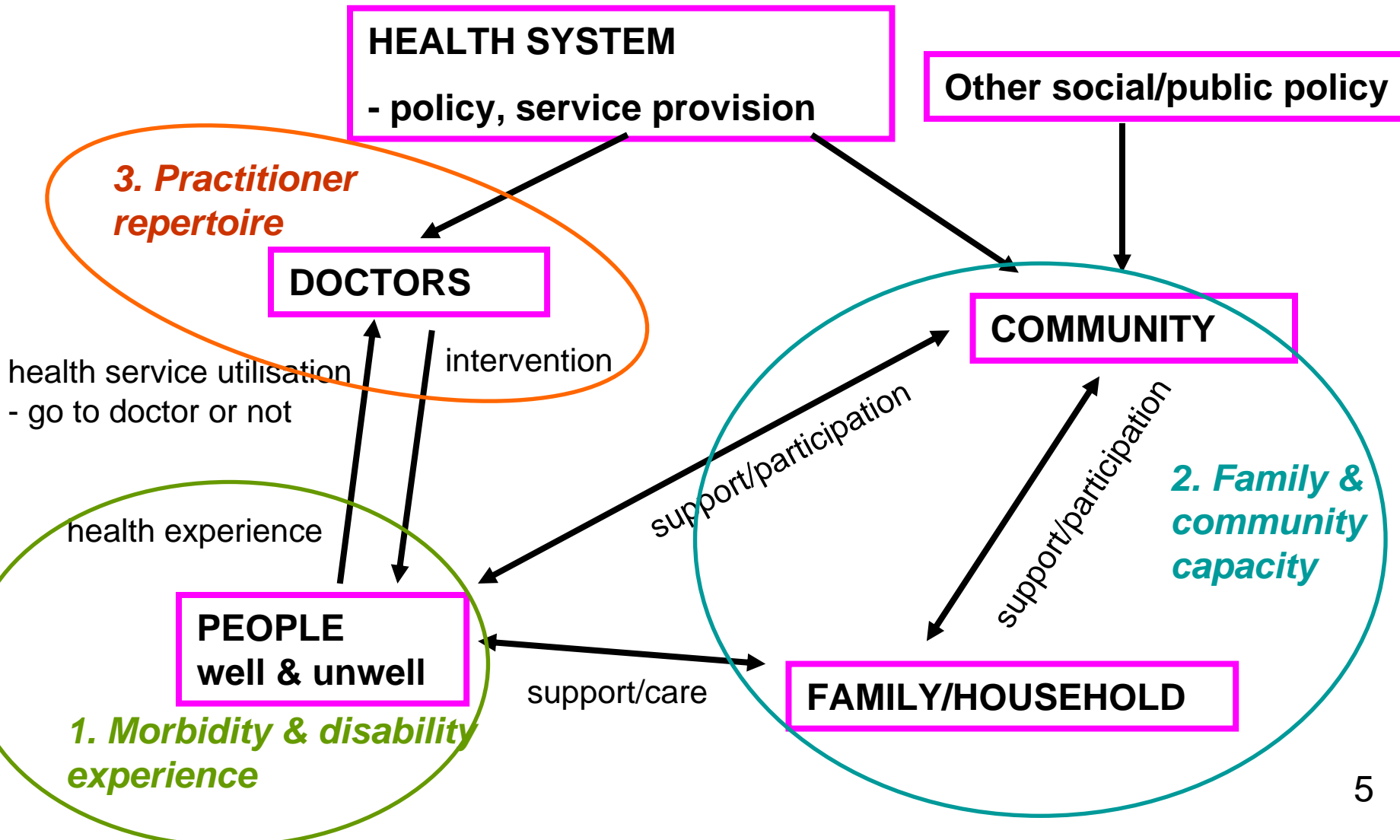
❑ Validation

❑ Scenario projection

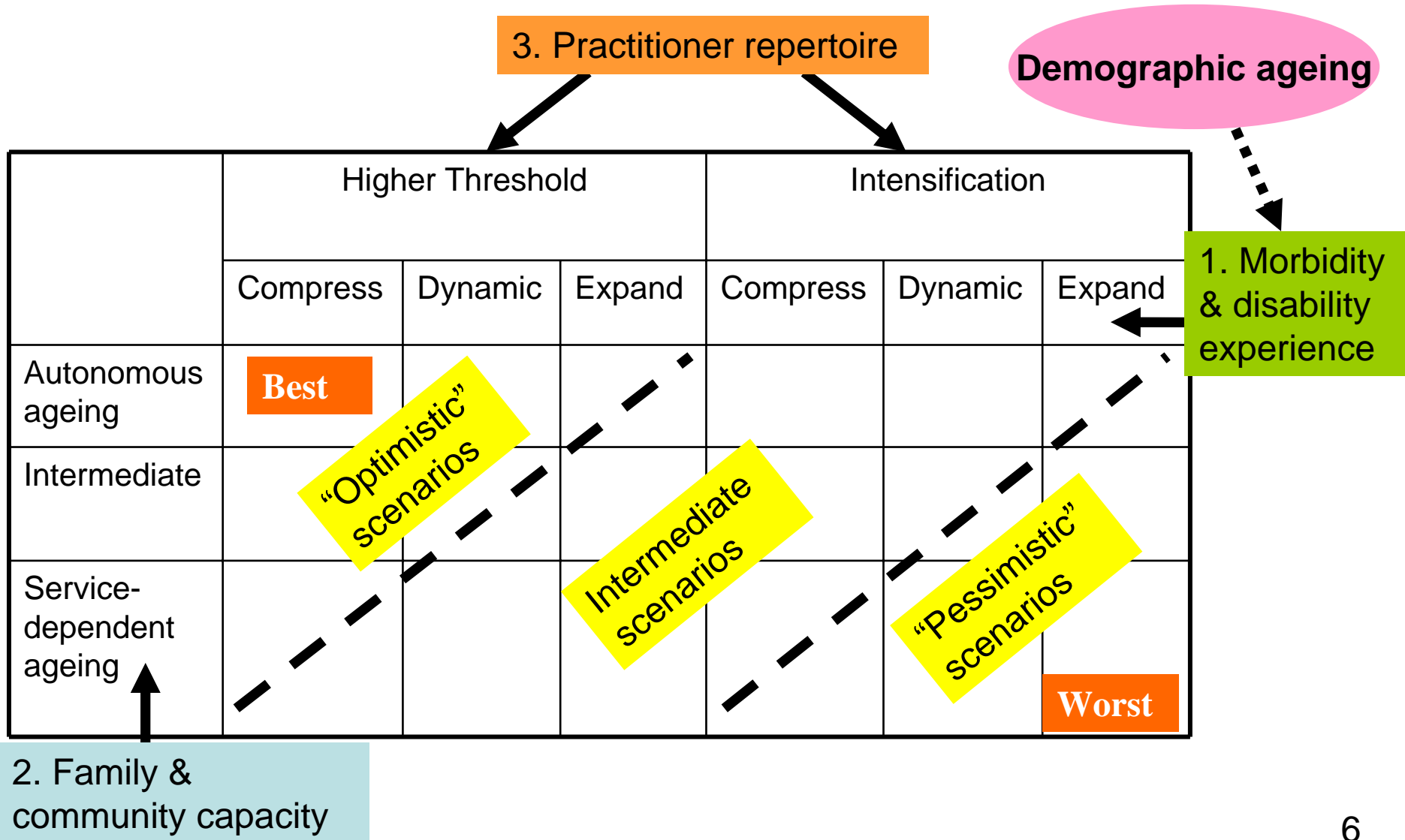
Purpose of modelling on this project

- **Using empirically dense, micro-simulation to:**
 - Test policy scenarios
 - Combine data from different sources
 - Represent system in realistic way
 - Build understanding “from bottom up”

Model of primary care



Core scenarios for simulation



➤ Concept

➤ Implementation

➤ Validation

➤ Scenario projection

Synthesised base file + imputed + imputed

NZ Health Surveys 1996/7 (children) & 2002/3 (adults) [n=13,548]	NZ GP Survey 2001/2: Doctor & Practice (via patient visits) [n=244 GPs]	OZ Health Survey 1995 [n=53,828]	NZ GP Survey 2001/2 : Patient visits [n=9,272]
Age		Age	Age
Gender		Gender	Gender
Ethnicity			Ethnicity
Deprivation			Deprivation
Number of visits in last 12 months			Number of visits in last 12 months
Living arrangements		Living arrangements	
Long-term conditions		Short-term & long-term condition categories	Primary diagnosis categories
		Go to doctor	
		1st listed reason for last visit in last 2 weeks	
		Number of visits in last 2 weeks	
			Number of diagnoses
	Doctor age, gender, ethnicity, etc		Severity
	Practice type, location, number of doctors		Doctor actions

Scenario testing ... policy sensitivity

Person id 2: Male, aged 40, lives with other

Doctor and practice characteristics

Has respiratory illness (primary condition)

Has other conditions

Goes to doctor

Investigation?

Prescription?

Follow up?

Referral?

Yes

No

Yes

No

static 2002 ... project into future

➤ Concept

➤ Implementation

➤ **Validation:** Comparing simulation output to GP Survey 2001/2 actual data

➤ Scenario projection

Validation 1. Average number of visits per year for persons visiting the doctor

Simulation	NZ GP Survey	Absolute error
6.9	6.6	0.3

Validation 2. For each condition category, percentage of all conditions seen in a year

Condition category	Simulation	NZ GP Survey	Absolute error
Respiratory system diseases	15.7	14.8	0.9
Cardiovascular/circulatory diseases	9.8	9.3	0.5
Musculoskeletal and connective tissue diseases	9.5	5.7	3.8
Digestive system diseases	6.7	4.4	2.3
Nervous system/sense organ diseases	6.0	8.2	2.2
Skin and subcutaneous tissue diseases	5.8	6.7	0.9
Endocrine/nutritional/metabolic/immunity disorders	5.5	4.1	1.4
Injury and poisoning	4.8	7.1	2.3
Genitourinary system diseases	3.6	4.6	1.0
Mental disorders	3.1	5.0	1.9
Infectious and parasitic diseases	2.6	4.3	1.7
Neoplasms	1.1	2.4	1.3
Diseases of blood and blood forming organs	0.7	0.5	0.2
Complications of pregnancy/childbirth/puerperium	0.1	0.3	0.2
Congenital anomalies	0.1	0.2	0.1
Symptoms, signs & ill-defined conditions, disability nec	3.6	3.5	0.1
Not an illness, non-symptomatic	21.5	19.0	2.5
Total	100%	100%	
		Average error	1.4

Validation 3. Percentage of visits per year with each type of doctor activity

Doctor activity	Simulation	NZ GP Survey	Absolute error
Investigation	21.6	24.8	3.2
Prescription	58.4	66.2	7.8
Non-drug treatment	59.7	62.0	2.3
Follow-up	57.1	57.2	0.1
Referral	14.1	15.8	1.7
		Average error	3.0

- ❑ Concept
- ❑ Implementation
- ❑ Validation
- ❑ **Scenario projection (2021)**
 1. *Demographic ageing*
 2. *Community support*
 3. *Doctor activity*

2002 population
adjusted by age,
gender, ethnicity

Projection to 2021: Demographic Ageing

1. Average number of visits per year for persons visiting the doctor: 2002 vs 2021

Sim 2002	2021	Change
6.9	7.1	0.2

Projection to 2021: Demographic Ageing

2. Condition categories as percentage of all conditions for persons visiting the GP in a year: 2002 vs 2021

Condition category	Sim 2002	2021	Absolute change
Respiratory system diseases	15.7	14.9	0.8
Cardiovascular/circulatory diseases	9.8	11.0	1.2
Musculoskeletal and connective tissue diseases	9.5	9.8	0.3
Digestive system diseases	6.7	6.8	0.1
Nervous system/sense organ diseases	6.0	6.0	0.0
Skin and subcutaneous tissue diseases	5.8	5.5	0.3
Endocrine/nutritional/metabolic/immunity disorders	5.5	5.8	0.3
Injury and poisoning	4.8	4.5	0.3
Genitourinary system diseases	3.6	3.4	0.2
Mental disorders	3.1	3.0	0.1
Infectious and parasitic diseases	2.6	2.4	0.2
Neoplasms	1.1	1.2	0.1
Diseases of blood and blood forming organs	0.7	0.7	0.0
Complications of pregnancy/childbirth/puerperium	0.1	0.1	0.0
Congenital anomalies	0.1	0.1	0.0
Symptoms, signs & ill-defined conditions, disability nec	3.6	3.4	0.2
Not an illness, non-symptomatic	21.5	21.3	0.2
Total	100%	100%	
		Average change	0.3

Projection to 2021: Demographic Ageing

3. Percentage of visits per year with each type of GP activity: 2002 vs 2021

Doctor activity	Sim 2002	2021	Absolute change
Investigation	21.6	22.0	0.4
Prescription	58.4	58.1	0.3
Non-drug treatment	59.7	58.9	0.8
Follow-up	57.1	58.8	1.7
Referral	14.1	13.9	0.2
		Average change	0.7

Projection to 2021: + Community Support scenario

Changing the number of adults living with a partner as a proportion of all people

		Scenarios		Counterfactuals	
		2021 Adults partnered 51% → 71% + 20	Increase partnered 71%	What if all adults partnered?	What if all adults unpartnered?
Average no. of visits per year for persons visiting the doctor	Sim 2002 6.9	7.1	7.1	7.0	7.2

Projection to 2021: + Doctor Activity scenario

Changing the proportion of Non-European (NE) doctors

Doctor activity	NZ GP Survey 2001/2		Scenarios		Counterfactuals	
	European doctors	Non- European doctors	Sim 2021 NE 37%	Increase NE 57%	What if All NE?	What if None NE?
	Percentage of visits with each doctor activity (%)					
Investigation	25.7	> 23.3	22.0	> 21.6	20.7	< 22.7
Prescription	65.3	< 68.0	58.1	< 59.4	62.2	> 55.8
Non-drug treatment	65.7	> 55.1	58.9	> 55.6	48.2	< 64.9
Follow-up	59.0	> 56.3	58.8	< 60.3	63.7	> 56.1
Referral	17.0	> 13.7	13.9	> 13.3	12.1	< 14.9

Conclusion

- ❑ A working micro-simulation model of primary medical care in New Zealand 2002 was constructed.
 - ❑ The model produced plausible results for key parameters.
- ❑ The model was used to test the impact of demographic ageing, community support and practitioner repertoire.
 - ❑ Model projections suggest limited change in system demand.
- ❑ There is potential for an enhanced model to become a useful tool for policy purposes.