New Zealand

Microsimulation models in New Zealand

COMPASS RESEARCH CENTRE

FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND

Whare Wānanga o Tāmaki Makaurau

The University of Auckland

Workshop on Microsimulation Models in Asia-Pacific Region
February 12, 2015

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Asia-Pacific

Aotearoa NZ

Outline

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- **COMPASS** Research Centre
- **Role of microsimulation in public policy development**
- Our microsimulation models
- Lessons learnt (and challenges)
- International collaboration
- Conclusion

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COMPASS Research: The Team

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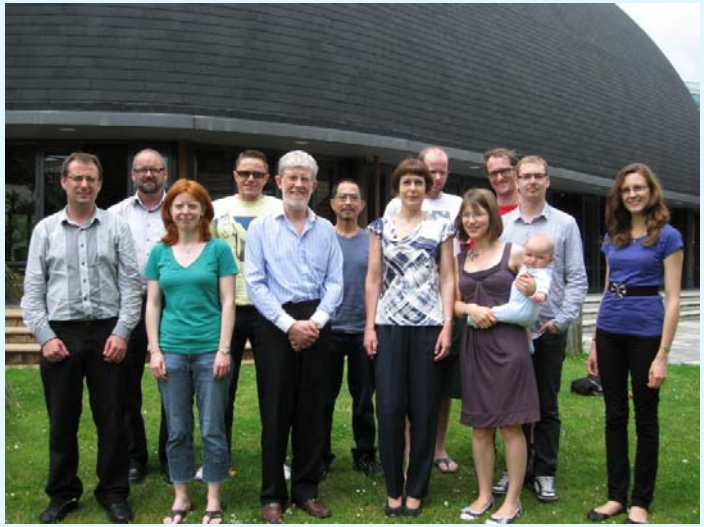
- COMPASS

= Centre of Methods and Policy Application in the Social Sciences

- ~10 years, public grant-funded
- Big user of existing data (analysis & modelling)
- Simulation models mostly policy-oriented



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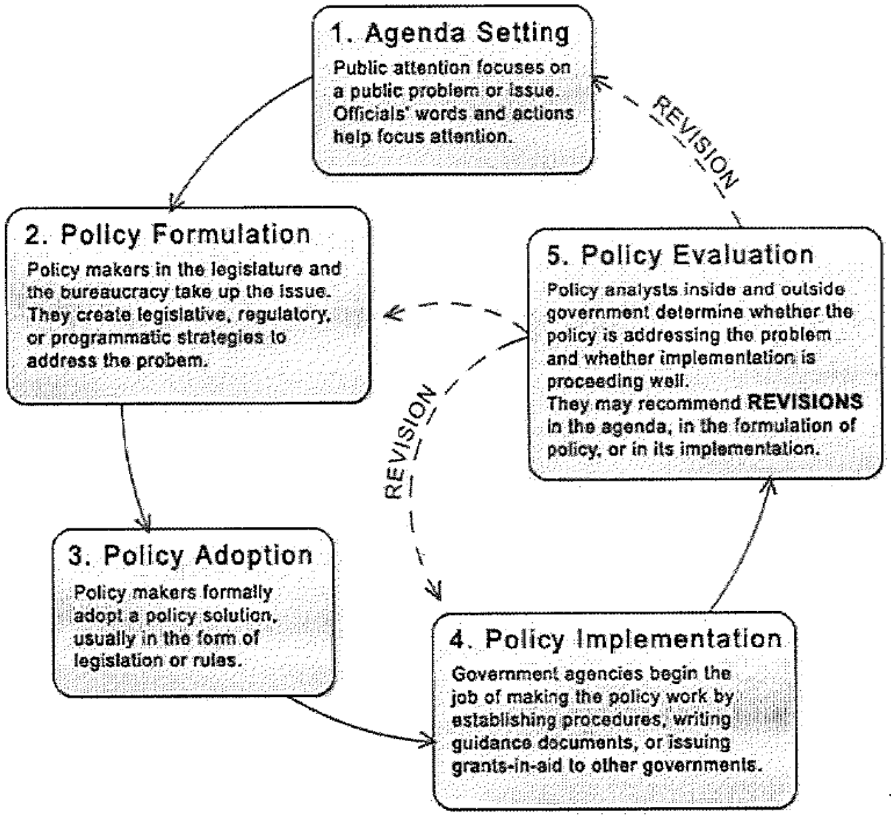
Policy-making cycle



Microsimulation: Role in policy development

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- Complexity and dynamism of policy issues
- Availability of ‘big data’ and IT advances
- Empirically based, but ability to experiment
- Forecasting, and ‘what if’ scenarios
- Testing impact of policies in silica before implementation
- Evaluating effectiveness of interventions after implementation

Policy decision support

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1. Add value to existing data
2. Present data within a realistic analytical framework
3. Use literature-derived estimates where appropriate
4. Construct a desk-based “tool” for interrogation
5. Work with colleagues in policy agencies throughout

COMPASS Simulation Suite

Model	Year	Locality	Type	Life stage	Domain	Software	Data	Funder	Collaborators	End-users
MOSC	2005-8	NZ	ABM/MSM	Adults	Marriage market, residential segregation	NetLogo Repast Java	Census	Marsden	UOA	
PCASO	2005-8	NZ	Static discrete-time MSM	Older people	Health care	SAS	NATMEDCA NZHS ANHS	HRC	UOA NatSem	
BCASO	2009-12	NZ	Dynamic discrete-time MSM	Older people	Health & social care	R	NZHS NZDS Census	HRC	UOA NatSem	
MEL-C	2009-13	NZ	Dynamic discrete-time MSM	Children	Health, education, conduct	Java R	CHDS DMDHS PIFS THNR Census2006	MBIE	UOA NatSem StatCan	MOE MOH MOJ MSD Te Puni Kokiri Families Commission Children's Commissioner
KNOW-LAB	2013-16	World	Dynamic discrete-time MSM	Children & young people	Health, education, conduct, etc.	Java R	Published literature	MBIE	UOA StatCan	

Mt Ngauruhoe – Bryan Lay-Yee

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- **Our microsimulation models**
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Our microsimulation models - what about them?

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- Research questions
- Conceptual model
- Data sources
- Model features
- Policy scenarios

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Our microsimulation models - which are they?

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- **Modelling demographic ageing and primary health care (PCASO 2005-8)**
- Modelling demographic ageing and long-term health and social care (BCASO 2009-12)
- Modelling the early life course (MEL-C 2008-2013)

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PCASO: Research questions

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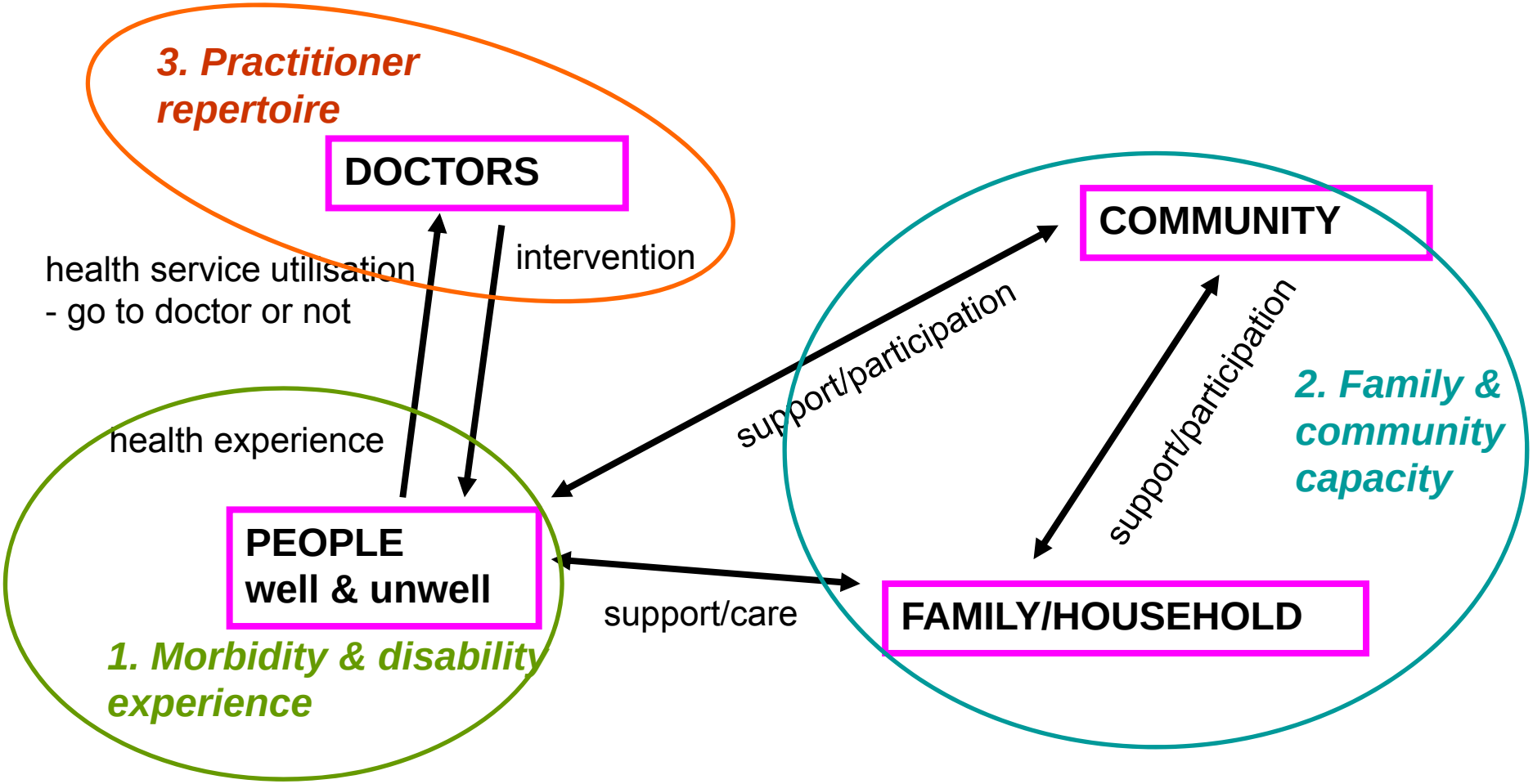
- Model the NZ family doctor system and test propositions about its functioning under different scenarios of demographic ageing
- Examples:
  - changing levels of morbidity, social support, and doctor prescribing

PCASO: Conceptual model



PCASO: New Zealand and Australian data sources and model contributions

Study	National Health Surveys	General Practice Survey (Doctors)	National Health Survey	General Practice Survey (Patient visits)
Country	New Zealand	New Zealand	Australia	New Zealand
Year	1996/7 (children) 2002/3 (adults)	2001/2	1995	2001/2
Sample	Children & adults	Doctors (GP)	Children & adults	Patient visits
N	13,548	244	53,828	9,272
Model Component	Community	Practitioner	Morbidity; Community	Morbidity; Practitioner

PCASO: Model features

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P=PCASO

- (P) Small or large
- (P) Simple or complex
- Deterministic or stochastic (P)
- Arithmetical or behavioural (P)
- (P) Static or dynamic
- Case-based or time-based (P)
- (P) Discrete time or continuous time
- Open or closed population (P)
- Base cohort or population (P)
- Base real or (P) synthetic

PCASO. **Scenario map:** Mean number of visits per year for GP users aged 65+ in 2021

Social support	**Morbidity experience**	
	Compress	*Expand*
Autonomous aging	8.8 visits	15.3
Service-dependent aging	8.7	15.2

PCASO. **Scenario map:** Percentage of visits prescribed for GP users aged 65+ in 2021

Social support	**Practitioner repertoire**			
	Higher threshold		*Intensification*	
	Morbidity experience			
	Compress	*Expand*	*Compress*	*Expand*
Autonomous aging	46.2% (4.1 visits)	47.0 (7.2)	87.0 (7.7)	87.9 (13.4)
Service-dependent aging	46.9 (4.1)	44.4 (6.7)	86.0 (7.5)	87.7 (13.3)

Summary of results

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- Decreased morbidity and increased social support reduces doctor visits
- Changed doctor behaviour reduces doctor visits and prescribing levels

Mt Taranaki – Bryan Lay-Yee

Our microsimulation models - which are they?

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- Modelling demographic ageing and primary health care (PCASO 2005-8)
- **Modelling demographic ageing and long-term health and social care (BCASO 2009-12)**
- Modelling the early life course (MEL-C 2008-2013)

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BCASO – Research questions

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- Model demographic ageing in NZ, and the utilisation of health and social care by older people

- Examples:
  - How would changing the balance of care between different modalities affect the overall use of care?

Data sources

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- Repeated 5-yearly cross-sectional surveys – health (NZHS: MoH) & disability (NZDS: SNZ)
- Starting sample (n=2807):
  - NZHS 2002 – living in the community (n=2206)
  - + NZDS 2001 – residential (n=601)
- Deriving simulation 'rules' – statistical equations (cross-sectional) & transition probabilities (from repeated cross-sections with 'steady progression' assumptions):
  - NZHS 2002, 2006; NZDS 1996, 2001
- Demographic adjustments (mortality, rejuvenation, calibration) - SNZ life tables; census/SNZ projections

BCASO: Model features

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B=BCASO

- (B) Small or large
- (B) Simple or complex
- Deterministic or stochastic (B)
- Arithmetical or behavioural (B)
- Static or dynamic (B)
- Case-based or time-based (B)
- (B) Discrete time or continuous time
- (B) Open or closed population
- Base cohort or population (B)
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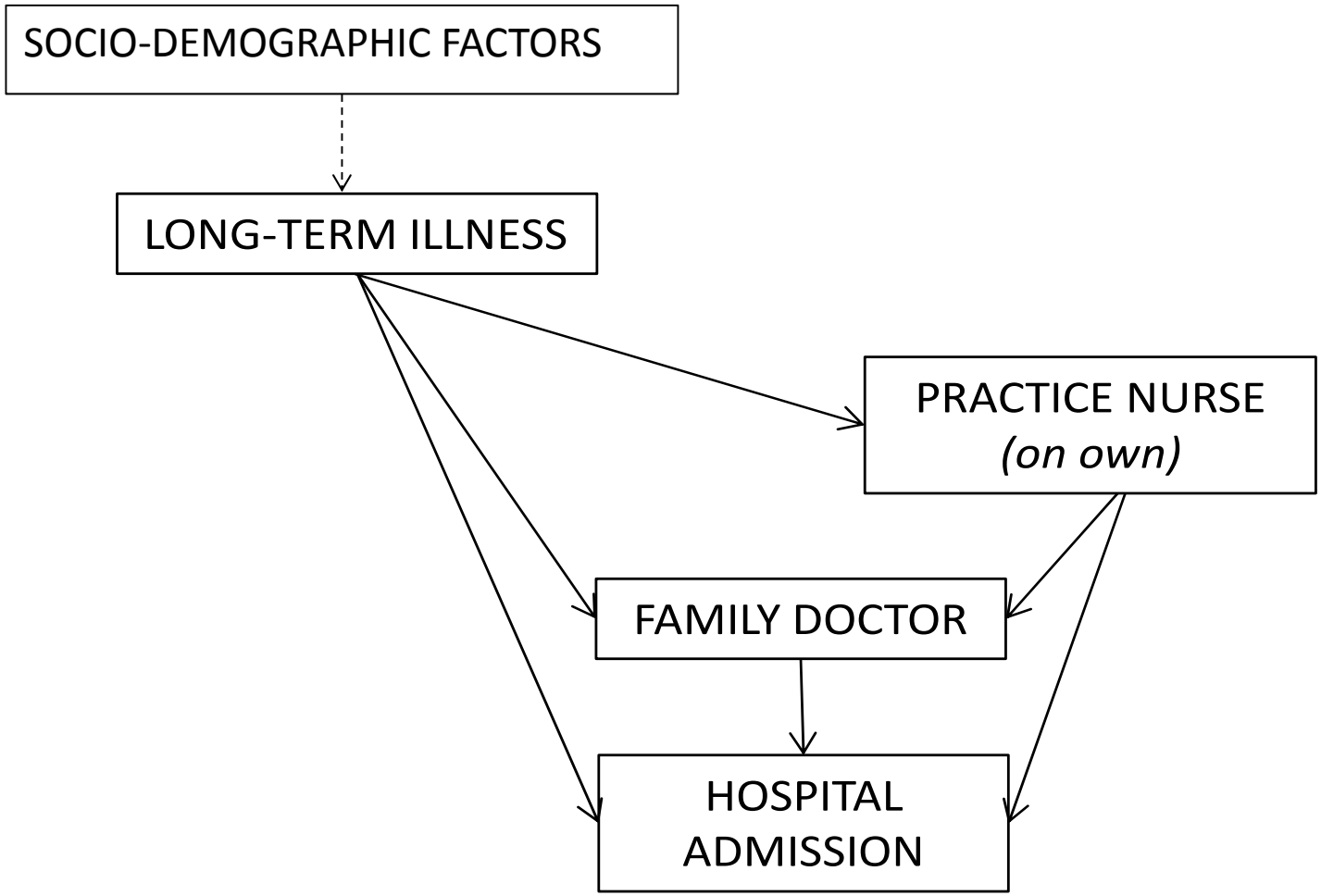
Conceptual model:
Late-life ageing & **health care** trajectory

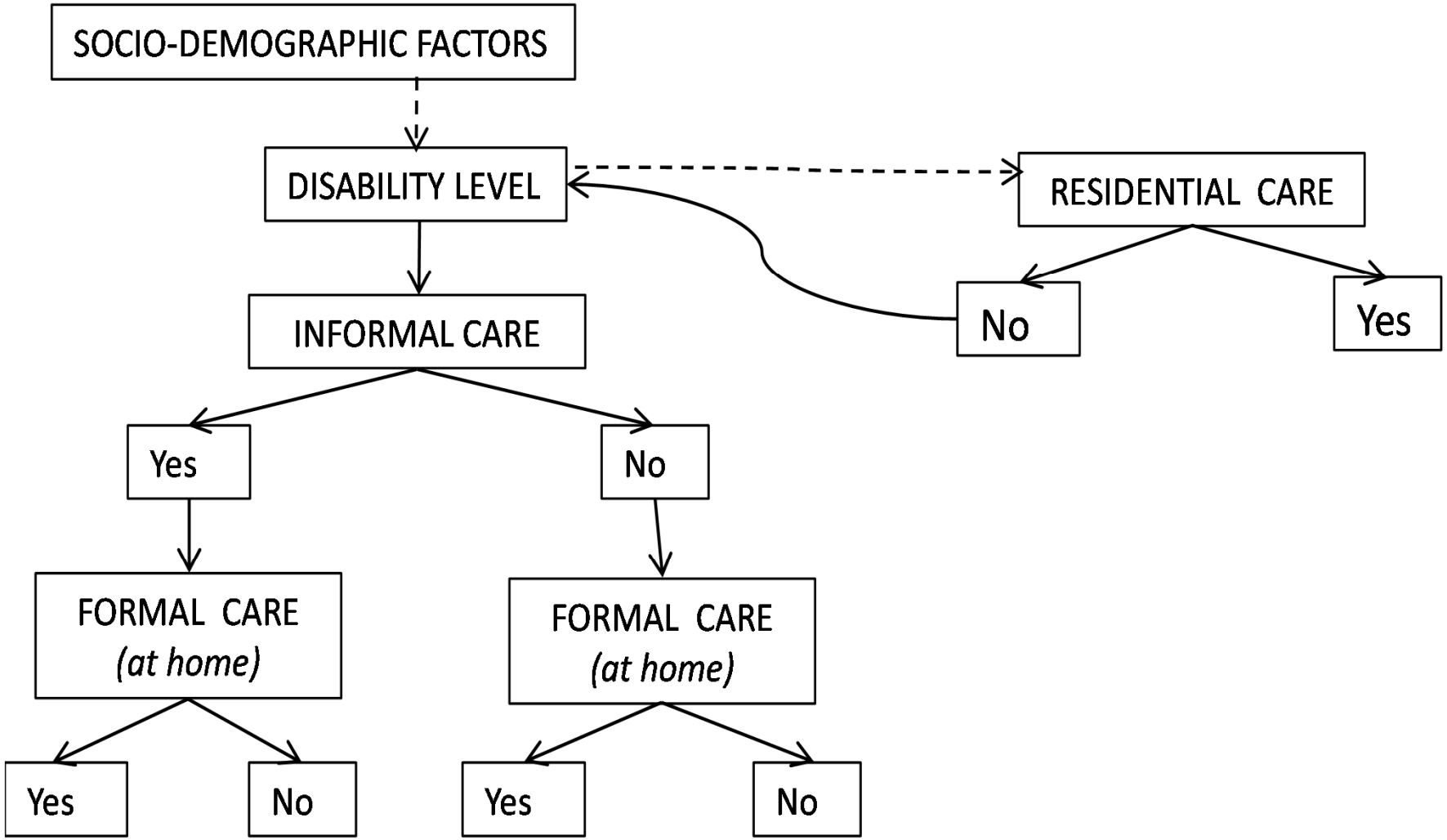


Results: **Increasing practice nurse use** for older people living in the community, 2021

Simulations	Health care modalities					
	Practice nurse (on own) (%)		Family doctor 5+ visits p. yr. (%)		Public hospital admission (%)	
	Aged 65+	Aged 85+	Aged 65+	Aged 85+	Aged 65+	Aged 85+
2021						
Base projection	43.3	42.4	43.5	48.8	21.8	23.1
Care scenario						
	5% increase		43.5	50.5	21.9	22.4
	10% increase		43.4	50.4	21.9	21.9
	20% increase		43.2	48.4	21.5	17.2
	50% increase		42.4	47.9	21.0	13.0
	All		40.6	46.0	19.8	9.3

- **Care scenario** - increasing level of practice nurse use (e.g. 85+ & 'All') reduced family doctor visits (by 6%), and hospital admissions (by 60%)

Conceptual model:
Late-life ageing & **social care** trajectory



Results: **Achieving reductions in residential care** for people aged 65+, 2021

Simulations	Social care modalities (for householders with some level of disability and residents)		
	Any informal (%)	Any formal (%)	Residential (%)
2001			
Base status quo	31.3	31.3	10.7
2021			
Base projection	36.1	31.9	11.0
Care scenario			
	36.1	31.9	5% reduction
	36.7	32.4	10% reduction
	36.9	32.6	20% reduction
	38.3	34.1	50% reduction

- **Base projection -** 2001 to 2021 shows increases in residential care (up 3%)
- **Care scenario** - setting reduced levels of residential care (e.g. by 20%) show that such reductions can be achieved by moderate increases in community care – informal (by 2%) and formal (by 2%)

Summary of results

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- The sheer volume of care required for larger numbers of older people may be alleviated by rebalancing care to make better use of finite resources,

  e.g. more use of practice nurses, and supported care in the community

Mt Tongariro – Bryan Lay-Yee

Our microsimulation models - which are they?

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- Modelling demographic ageing and primary health care (PCASO 2005-8)
- Modelling demographic ageing and long-term health and social care (BCASO 2009-12)
- **Modelling the early life course (MEL-C 2008-2013)**

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MEL-C: Research questions

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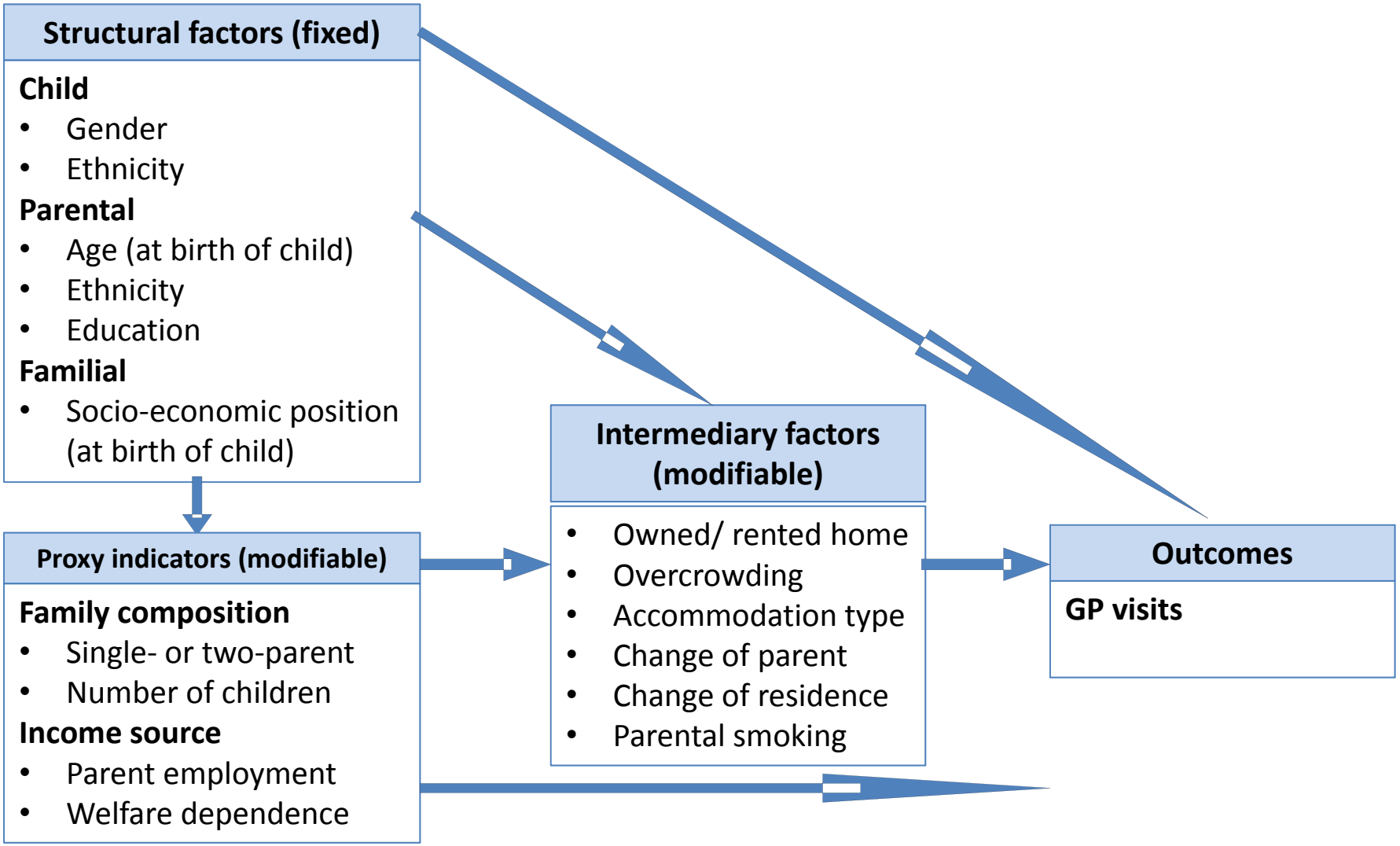
- Model key determinants of child outcomes in the early life course
- Examples: What is the effect of improving various determinants on access to GP care?
  - Q1. Are structural or intermediary factors more influential?
  - Q2. Is there greater impact on socially disadvantaged groups?

Model of structural and intermediary influences on child outcomes (Christchurch study data only)



Four Studies, and NZ Census

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- Christchurch Health & Development Study (CHDS)
  - 1265 children born in Christchurch 1977
- Dunedin Multidisciplinary Health & Development Study (DMHDS)
  - 1037 children born in Dunedin 1972/3
- Pacific Islands Families Study (PIFS)
  - 1398 children born at Middlemore Hospital, 2000, with at least one parent of Pacific Islands ethnicity
- Te Hoe Nuku Roa Study (THNR) Longitudinal study of Māori households (beginning 1995)
- 568 children (0-12)
- NZ Census 2006
  - Used to create synthetic base-file of10,000 composite children

MEL-C: Model features

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M=MEL-C

- Small or (M) large
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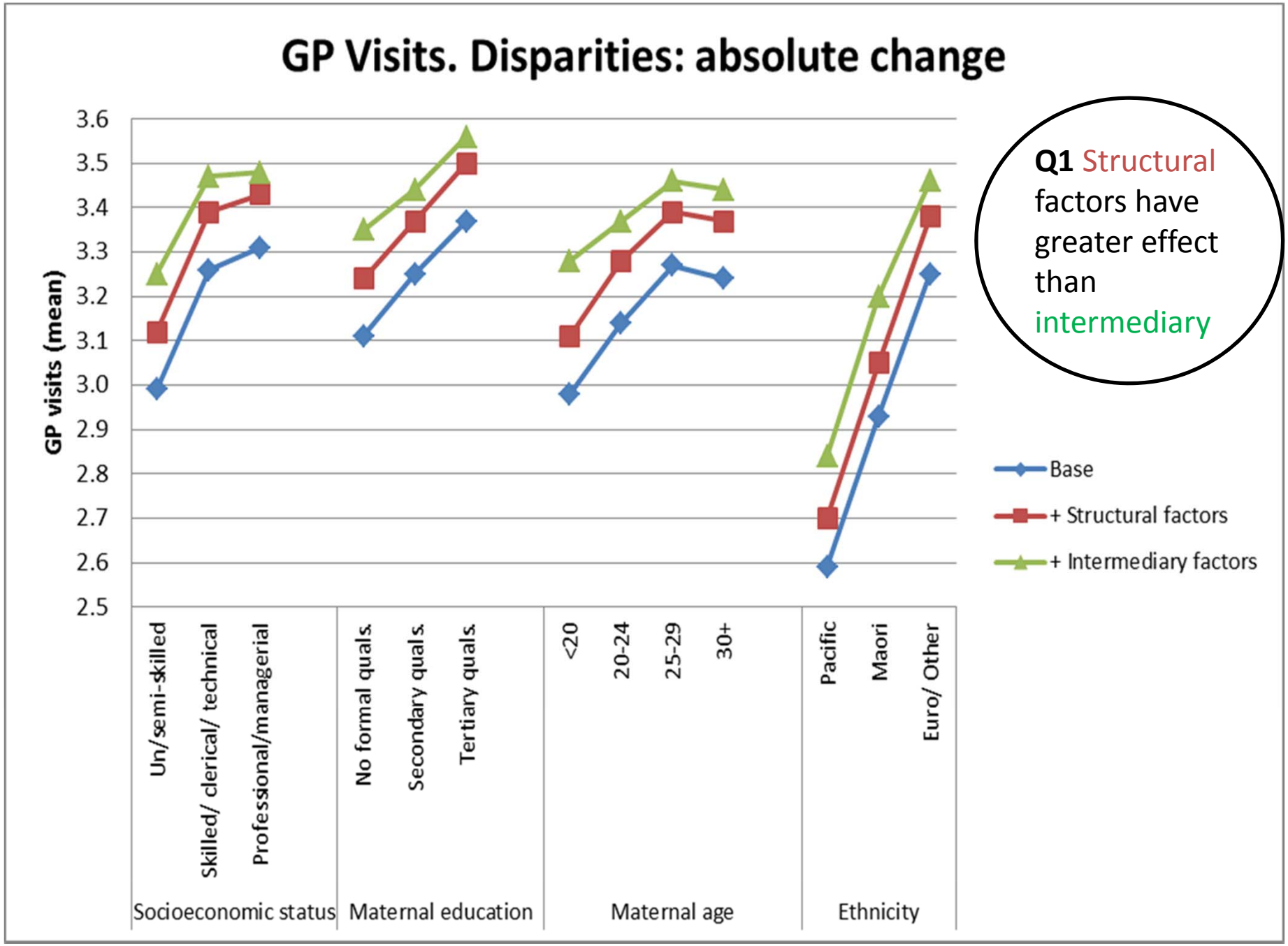
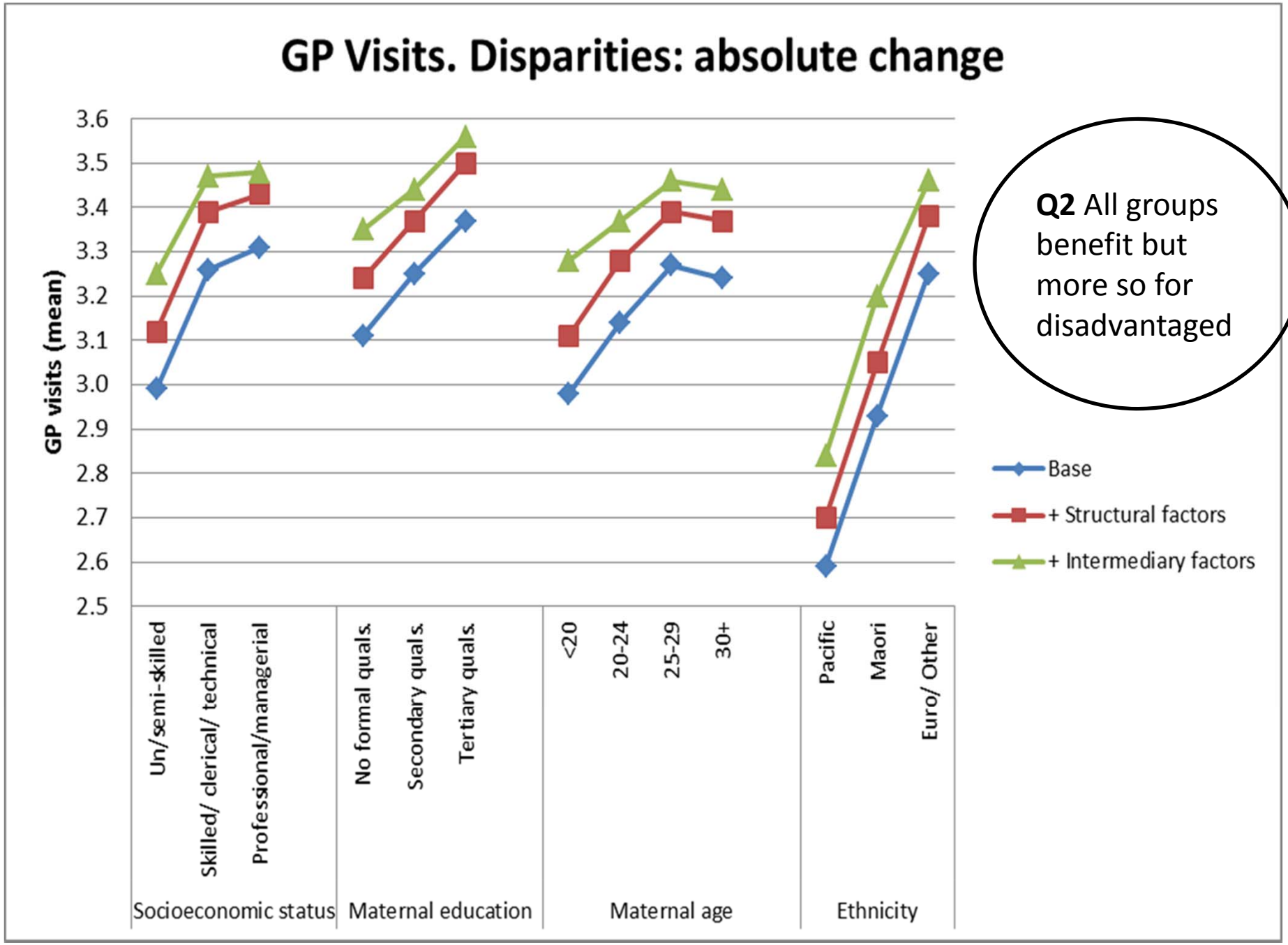

GP Visits. Disparities: absolute change
GP visits (mean)
3.6
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
Un/semi-skilled
Skilled/ clerical/ technical
Professional/managerial
No formal quals
Secondary quals
Tertiary quals
<20
20-24
25-29
30+
Pacific
Maori
Euro/ Other
Socioeconomic status
Maternal education
Maternal age
Ethnicity
Base
+ Structural factors
+ Intermediary factors
Q1 Structural factors have greater effect than intermediary


GP Visits. Disparities: absolute change
GP visits (mean)
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Skilled/ clerical/ technical
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No formal quals
Secondary quals
Tertiary quals
<20
20-24
25-29
30+
Pacific
Maori
Euro/ Other
Socioeconomic status
Maternal education
Maternal age
Ethnicity
Base
+ Structural factors
+ Intermediary factors
Q2 All groups benefit but more so for disadvantaged

Summary of results

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- Q1: Effect of modifiable structural factors is greater than of intermediary factors
- Q2: “Inverse” effect gradient: i.e. progressively more positive impact on outcome with greater social disadvantage

Mahuia Rapids – Bryan Lay-Yee

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- Role of microsimulation in public policy development
- Our microsimulation models
- **Lessons learnt (and challenges)**
- **International collaboration**
- **Conclusion**

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Lessons learnt (challenges presented)

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- Sufficient resources – time, financial, computing, human, data
- Building a team and work programme
- Multi-disciplinary perspectives
- Stake-holder engagement – data providers; 'co-creation' with policy-makers
- Communication – transparency, understandable, 'open science'
- International collaboration

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International collaboration – 'making the circle wide'

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- Sharing expertise – concepts; methods
- Sharing data sources
- Not having to 're-invent the wheel'; synergies
- Developing and adhering to accepted best practice standards
- Resource-effective (incl. cost); co-funding
- Cross-national comparisons
- Examples:
  - Specific projects above – Australia, Europe, Canada
  - eGovPolinet consortium – world-wide

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eGovPoliNet Consortium

"Multidisciplinary group of experts in ICT enabled solutions for public governance and policy modelling."

University of Koblenz-Landau (coordinator), **Germany**
Technical University Kosice, **Slovakia**
Technical University Delft, **Netherlands**
Centre for Research and Technology Hellas (CERTH), **Greece**
Volterra Partners LLP, **United Kingdom**
Innova SPA, **Italy**
Free University Brussels, **Belgium**
University Laval, **Canada**
Brunel University, **United Kingdom**
Center for Technology in Government, University at Albany, **United States of America**
University Groningen, **Netherlands**
University of Auckland, **New Zealand**
Khmelniskiy National University, **Ukraine**
Pontifícia Universidade Católica do Paraná, **Brazil**
UN University International Institute for Software Technology (UNUIIST), **People's Republic of China**
Moscow State University, **Russian Federation**
University College Dublin, National University of Ireland, Dublin, **Ireland**
University of Technology Sydney, **Australia**
EA European Academy of Technology and Innovation Assessment GmbH, **Germany**
St Petersburg National Research University of Information Technologies Mechanics & Optics, **Russian Fed.**

Conclusion

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- Micro-simulation and decision support/inquiry system
  - With the right empirical and conceptual anchoring, and working closely with colleagues in the policy process, our tool could be the basis of a more evidence-informed policy approach
- Future plans
  - Insert effect estimates from the literature (knowledge laboratory)
  - Assess more complex interventions and outcomes
  - Improve causal power of underlying statistical analysis
  - Broaden stake-holder engagement
  - Further develop international linkages

Selected Research Outputs

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Hamilton's Gap Sunset– Bryan Lay-Yee

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Microsimulation models in New Zealand (Aotearoa)

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