New Zealand

Modelling the early life-course: A decision support tool for policy makers

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COMPASS RESEARCH CENTRE

FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

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Outline

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- Modelling the Early Life-course (MEL-C)
  - What? Why? How? Micro-simulation
- MEL-C – Key features
  - Representative starting population
  - Conceptual framework
  - Transition probabilities (associations between paths)
  - Simulating results
  - Validation
  - Testing policy scenarios
- Some results
- Conclusions

New Zealand context

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- Island nation in South Pacific
  - Colonised Māori 1250-1300AD (European ~1800AD)
- Population: 2013: 4.5m
  2006: 4.15m
- Ethnicity
  - 2006 <u>births</u>: 58% NZ European, 24% Māori, 9% Asian, 9% Pacific
- (Mostly) good social statistics...
  - High rates of child poverty, child health conditions
  - Increasing socio-economic and ethnic equality

MEL-C
- What? Why? How?

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1. Goals … what are we trying to do?

- Develop a software application as a decision-support tool for policy-making

2. Rationale … why are we doing it?

- To improve policymakers' ability to respond to issues concerning children and young people

3. Means … how are we doing it?

- By building a computer simulation model with data from existing longitudinal studies to quantify the underlying determinants of progress in the early life course

MEL-C
- Micro-simulation

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- Micro-simulation
  - Use data from the real world to create an artificial one that mimics the original.
  - Carry out ‘virtual’ experiments with artificial world (Gilbert and Troitzsch 2005).
  - Simulate individual units and aggregate these to get population estimates
  - Requirements
    - Starting population
    - Rules to transition individuals from state to state

MEL-C How?

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- We start with a sample of individuals
  - Synthetic (derived from Census)
- We derive statistical rules to create a 'virtual cohort' through to age 13
  - Analyse combined data from 3 longitudinal studies
  - A sample of children with typical biographies over the life-course, allowing for variation
- We then simulate what might happen if policy were to change, by altering parameters
  - Using software application

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Key features - Starting population

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- Subset NZ 2006 Census to include just new-borns (0-year olds) and their parents
  - Randomly select 10,000 (Processing speed)
- Calculate distance (Euclidean) between each of the 10,000, based on 52 Census characteristics.
- Choose the closest 2 ranks to form 10,000 clusters of 3 individuals
- Randomly choose which indiv's characteristics are used for each synthetic individual
  - Characteristic by characteristic

Key features - Starting population

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	Cluster of 3 Children				
Characteristic	Child 1	Child 2	Child 3	Random Draw {1,2,3}	Synthetic child
Child sex	Male	Female	Female	2	Female
Mother age	29	41	31	1	29
Father age	32	40	38	1	32
Home ownership	Owned	Owned	Rented	3	Rented
Deprivation score (1-10)	9	7	8	3	8

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Key features - Starting population

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- Voilà! A synthetic basefile of 10,000 composite individuals
- Match Census distributions and inter-relations

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Key features - Conceptual framework

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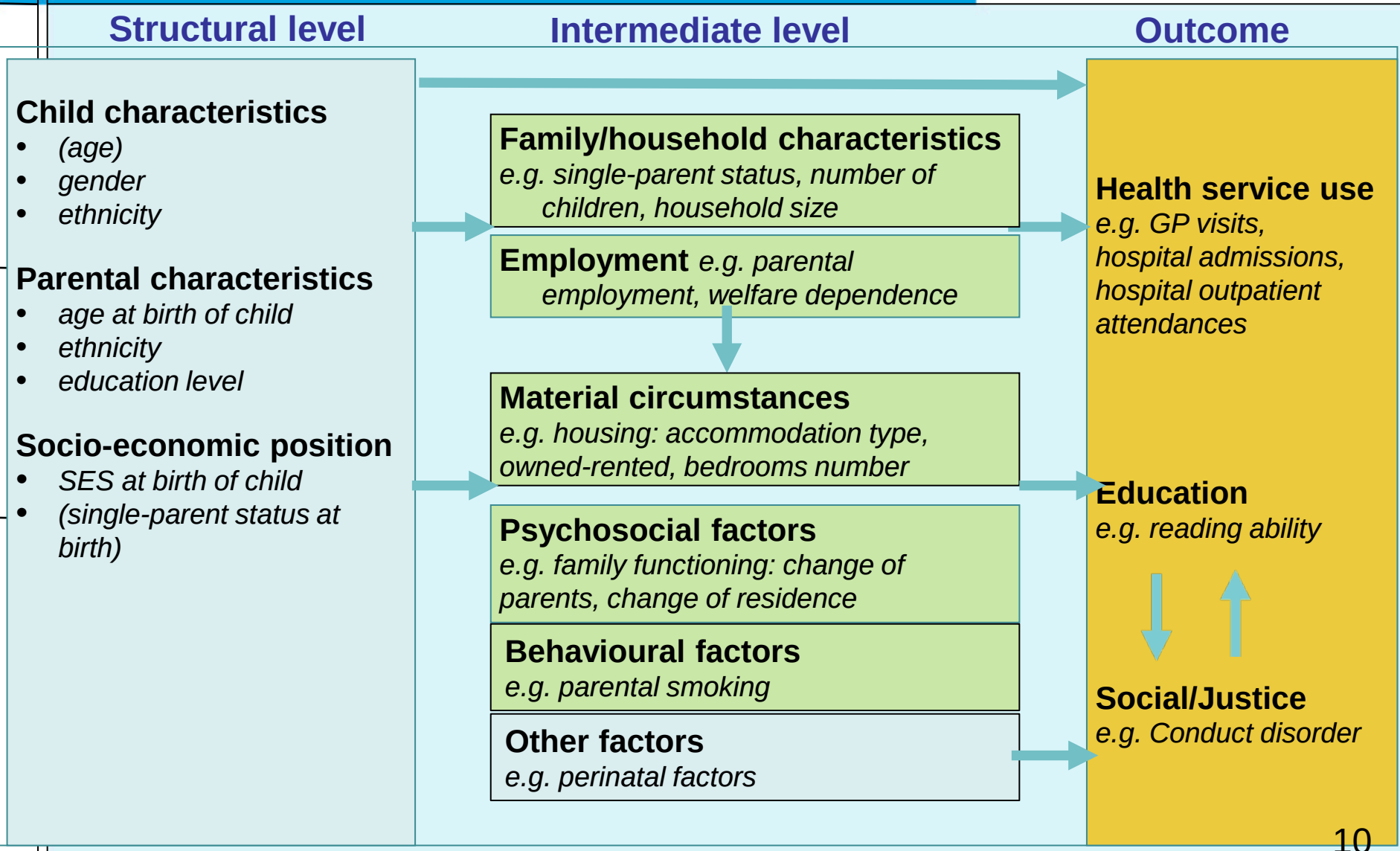

Key features
- Transition probabilities

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- Combined data from 3 NZ longitudinal studies
  - Christchurch Health & Development Study (CHDS)
    - 1265 children born in Christchurch, 1977. Followed since.
  - Dunedin Multidisciplinary Health & Development Study (DMHDS)
    - 1037 children born in Dunedin, 1972/73. Followed since.
  - Pacific Islands Families Study (PIFS)
    - 1398 children born at Middlemore, 2000, with at least one parent of Pacific Islands ethnicity. Followed since.
- Regression analysis of each path in conceptual framework
  - Data weighted to represent NZ current ethnic distribution
  - Māori data weighted to represent NZ Māori national cultural affiliation distribution (Te Hoe Nuku Roa Study)

Key features - Simulating results

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Simulating Reading score: Simplified rule from statistical model:

E[reading score] = 13.00 + .91*reading.score.previous + .07*months.breast.fed + 1.04*father.tertairy.qualification + .87*father.secondary.qualification

	Child A
Characteristics	
Reading score at age 8	40
Number of months breast fed	12
Father's Education	Secondary
Predicted reading score at age 9	`13.00 + .91*40 + .07*12 + .87` = 50.58
Random draw from a normal distribution	50.23
Reading score assigned at age 9	50

Apply Rule

Expected value

Stochastic component

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Key features - Validation

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- Models need to simulate real world accurately
- Given we start with a representative NZ population (synthetic base file), we should simulate NZ national rates
- Compare simulated rates with published rates / available datasets
  - NZ Heath Survey (GP visits, outpatient attendances)
  - NMDS (hospital admissions)
  - Burt Reading norms (reading)
  - Nothing for conduct – only national rates available are based on the longitudinal studies we use in our models!

Key features - Validation

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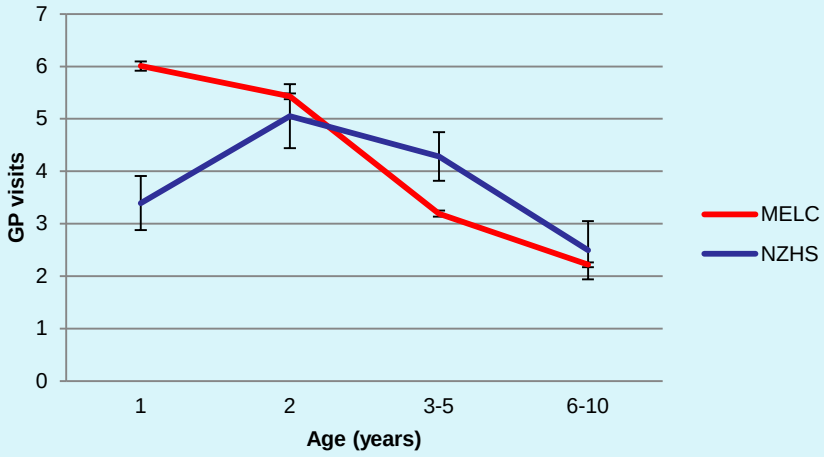

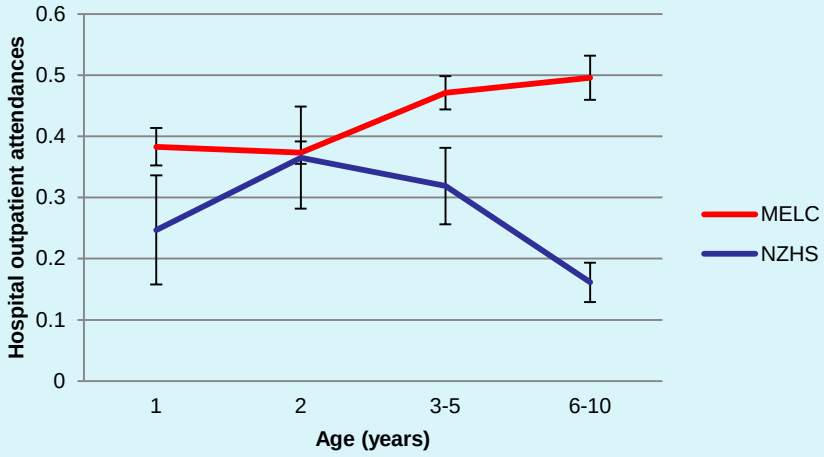

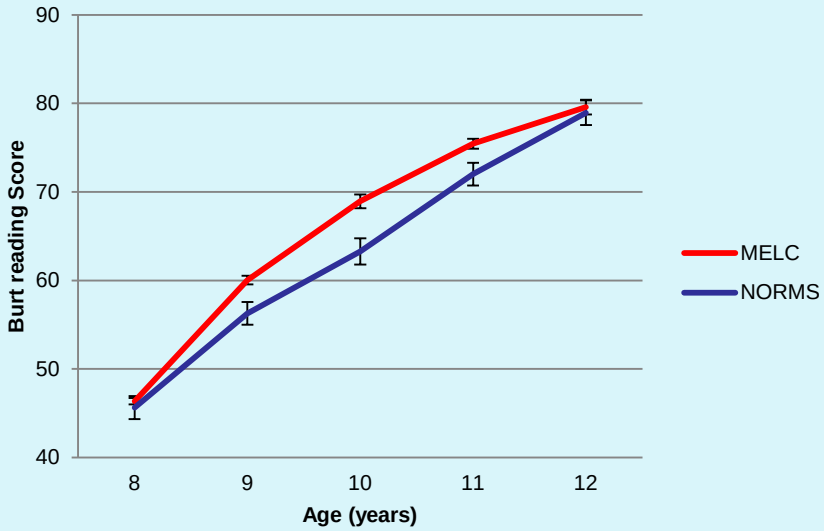

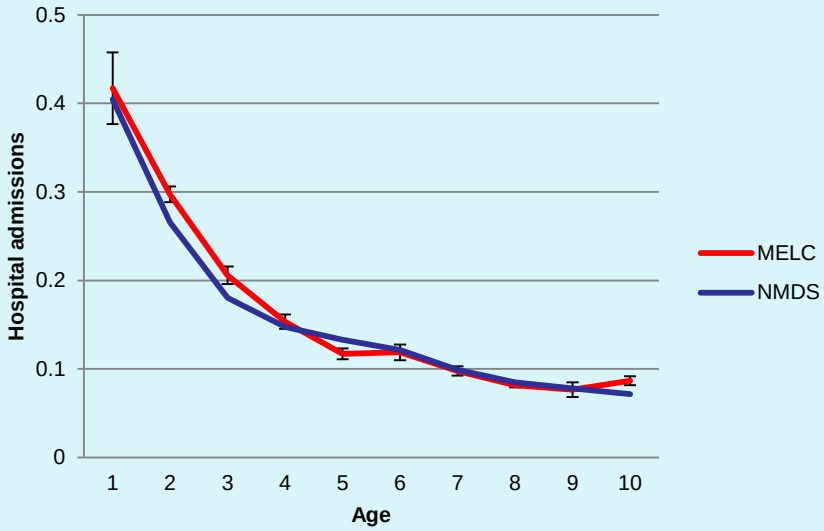

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Key features
- Validation (realigned)

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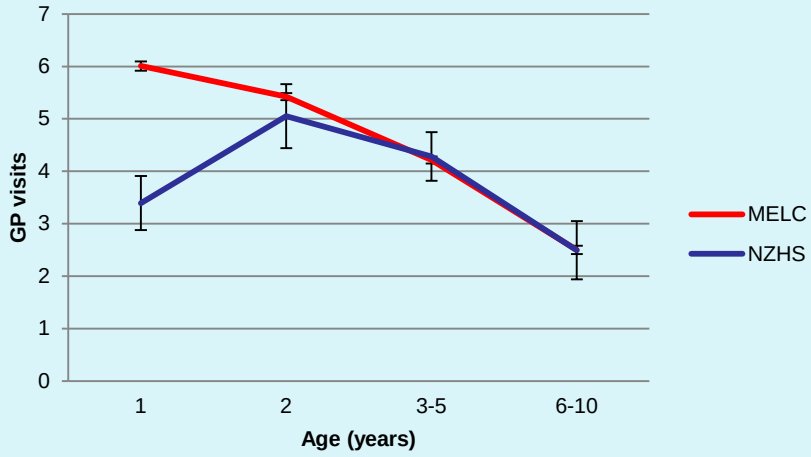

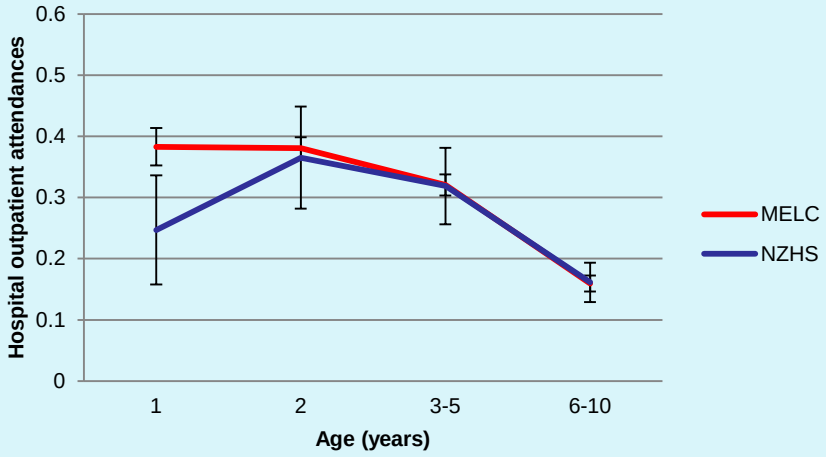

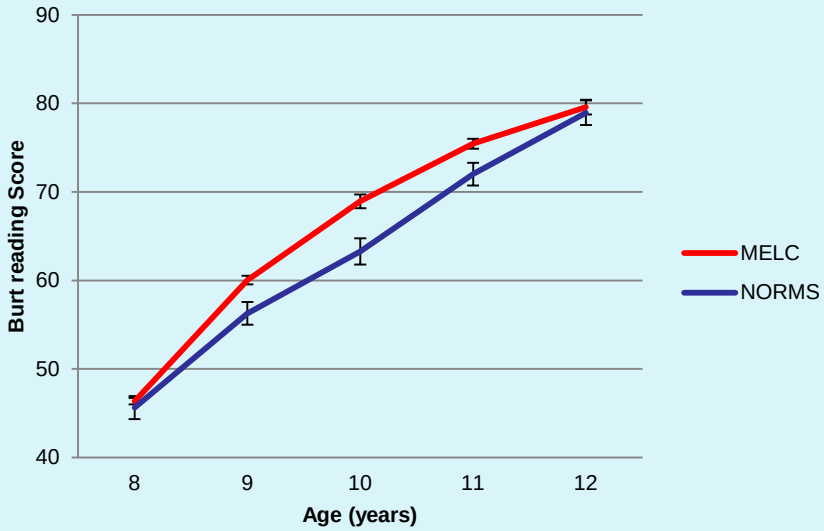

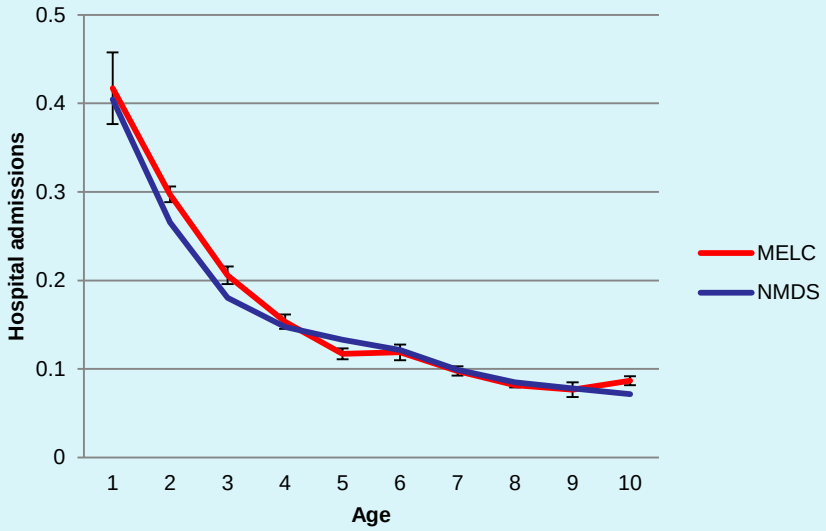

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Key features
- Testing policy scenarios

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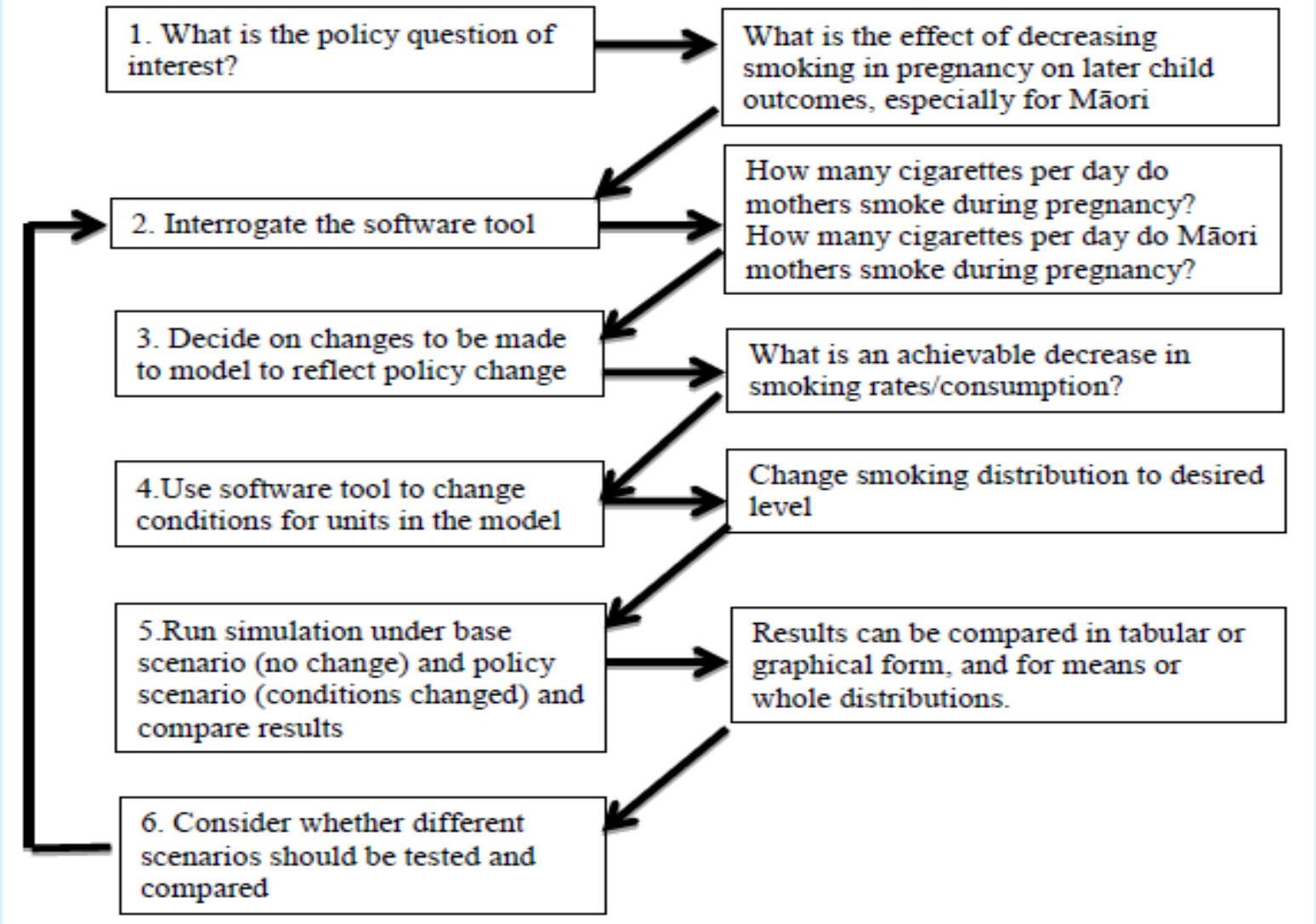

Modelling software

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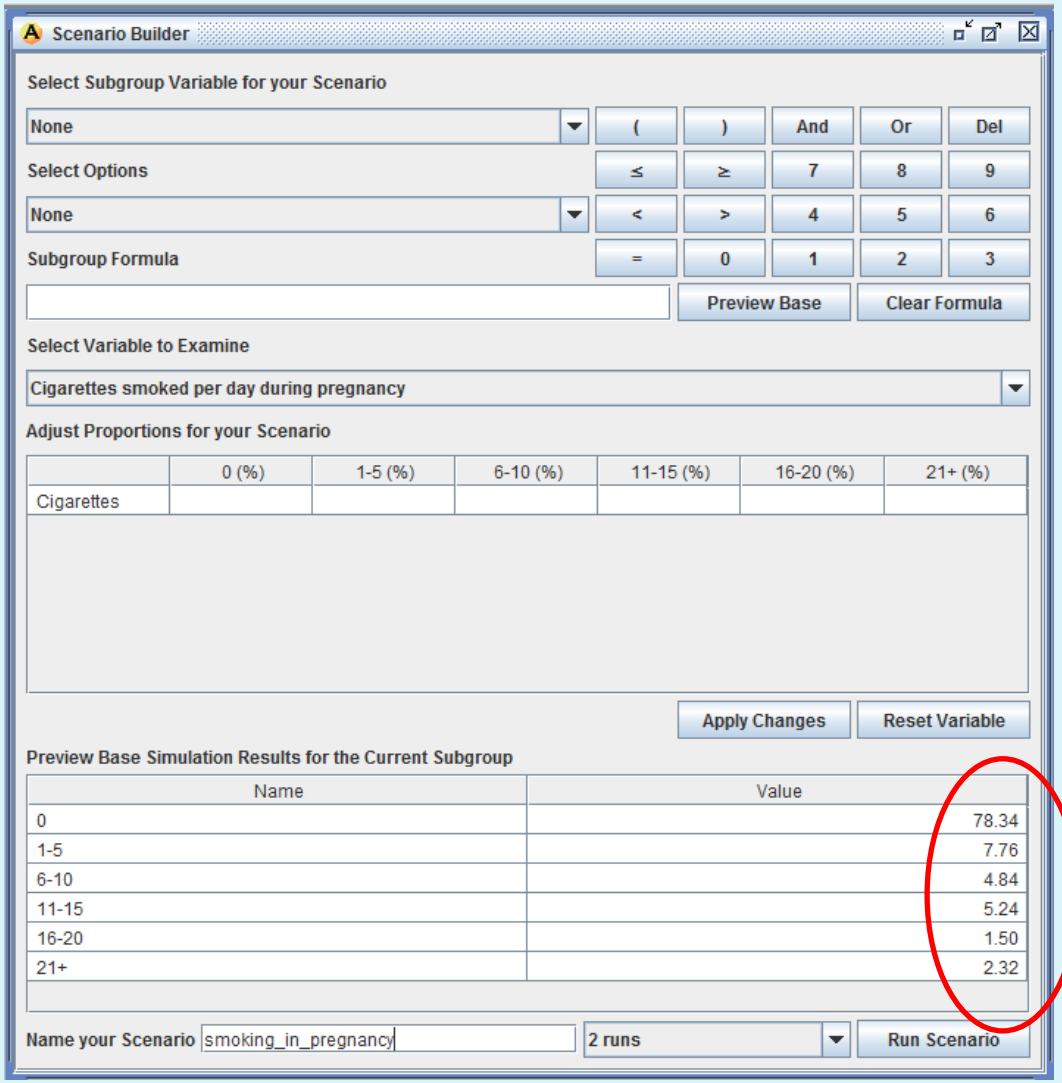

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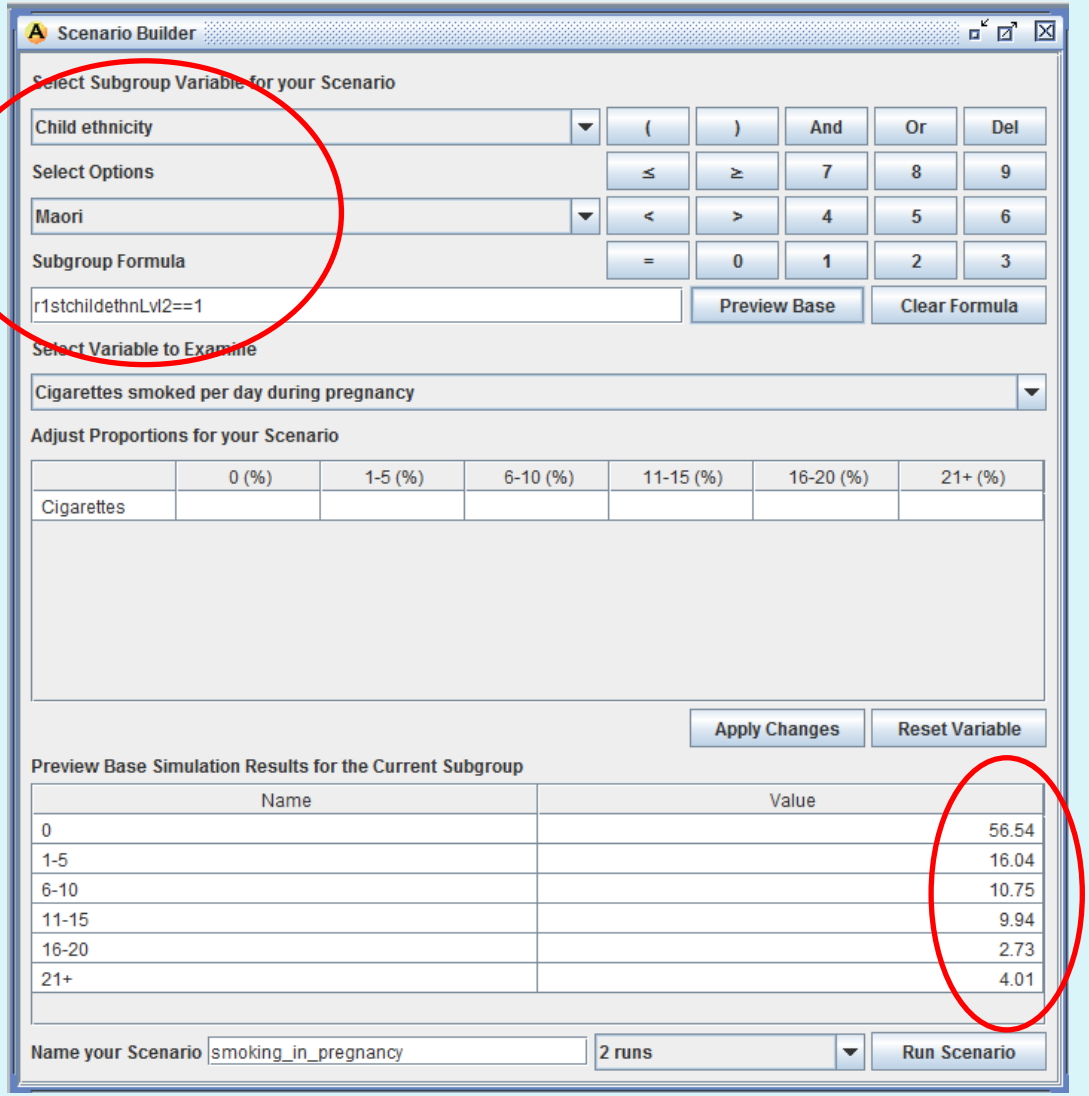

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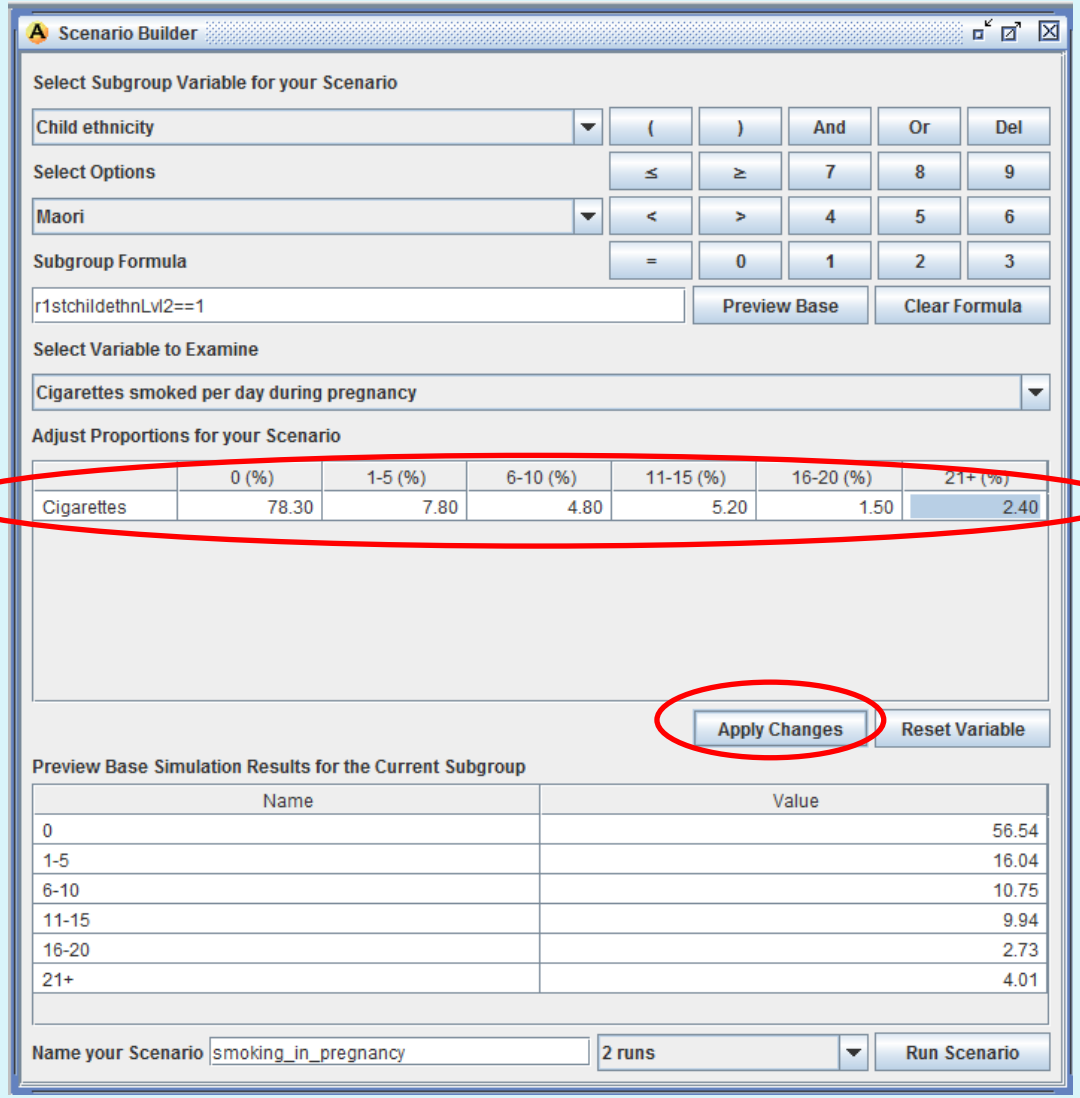

Results

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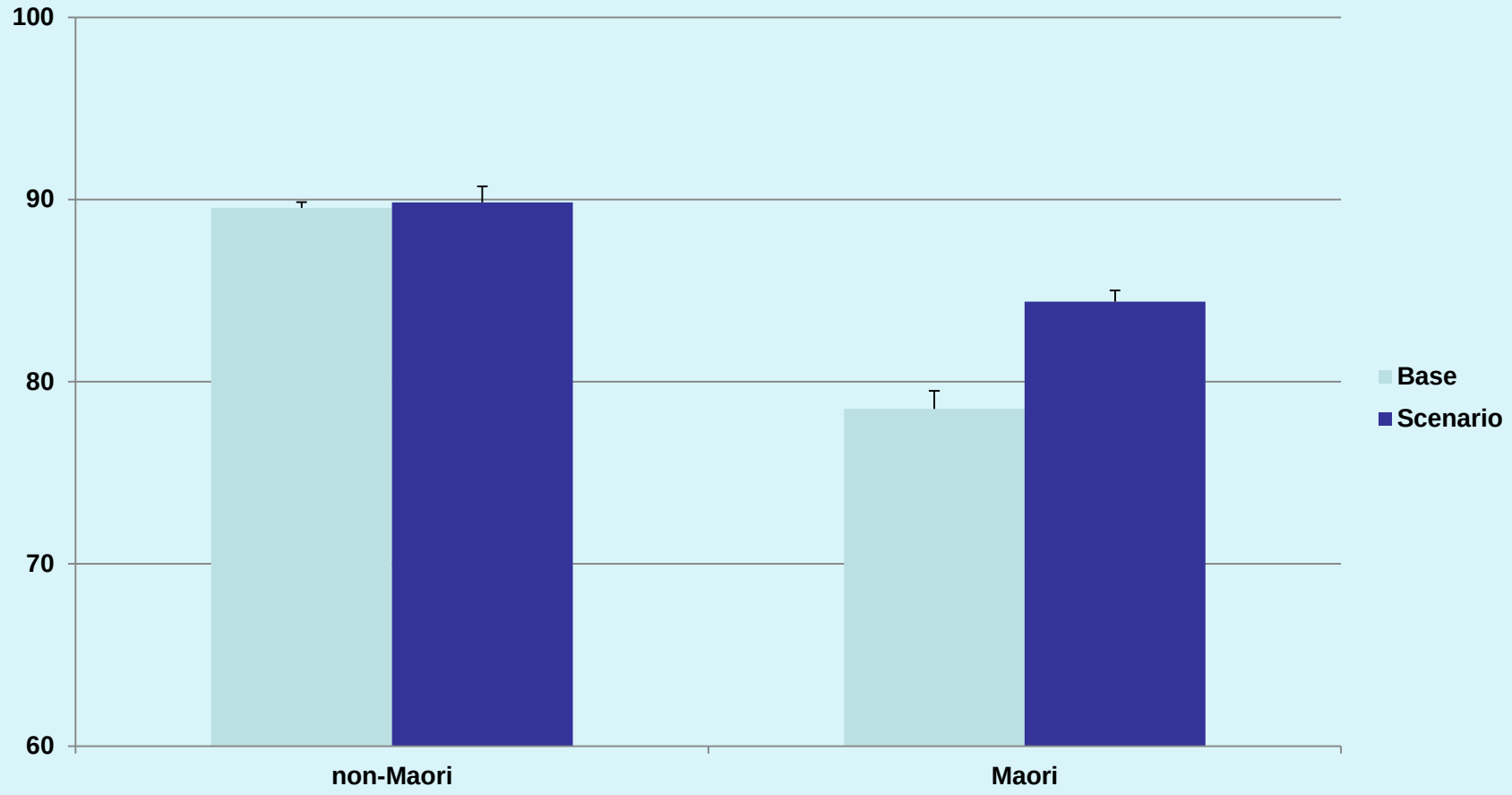
Reading Scores – age 13



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Conclusions

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- Able to assess scenarios relevant to policy-makers via tool/user-interface
  - Tested by policy makers, final version deployed
- Assess policy scenarios for whole population or for important sub-populations
- Use of existing data for simulation rules and for simulation starting population
  - Extend to use published ‘best’ estimates for rules
- Several scenarios can be assessed

QUESTIONS?

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QUESTIONS?