New Zealand

Can public policy make a difference to the most disadvantaged? A simulation approach

COMPASS RESEARCH CENTRE

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

The University of Auckland

7th COMPASS Colloquium

Statistics NZ, Wellington

30 August 2013

Roy Lay-Yee & MEL-C Team
University of Auckland, New Zealand
and COMPASS Research Centre
www.compass.auckland.ac.nz

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

Determinants & disparities

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- Social determinants of health framework (WHO Commission 2008, Marmot Review 2010) – well established
  - But how do we show that efforts to tackle health and health care disparities will make a difference?

- What we are offering
  - Counterfactual modelling ('what if?') – using a simulation model, based on real data
  - Aim to test the differential impact of changing selected determinants on child outcomes for disadvantaged groups
  - Model developed in health but applicable to other public policy domains

Outline

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- **Section 1 (Rationale)**
  - **What is MEL-C?**
  - **Conceptual model**
  - **Research questions**
  - **Determinants and outcomes**
- Section 2 (Method)
  - Microsimulation
- Section 3 (Policy application)
  - Scenario testing: Base and counterfactuals
  - Conclusion

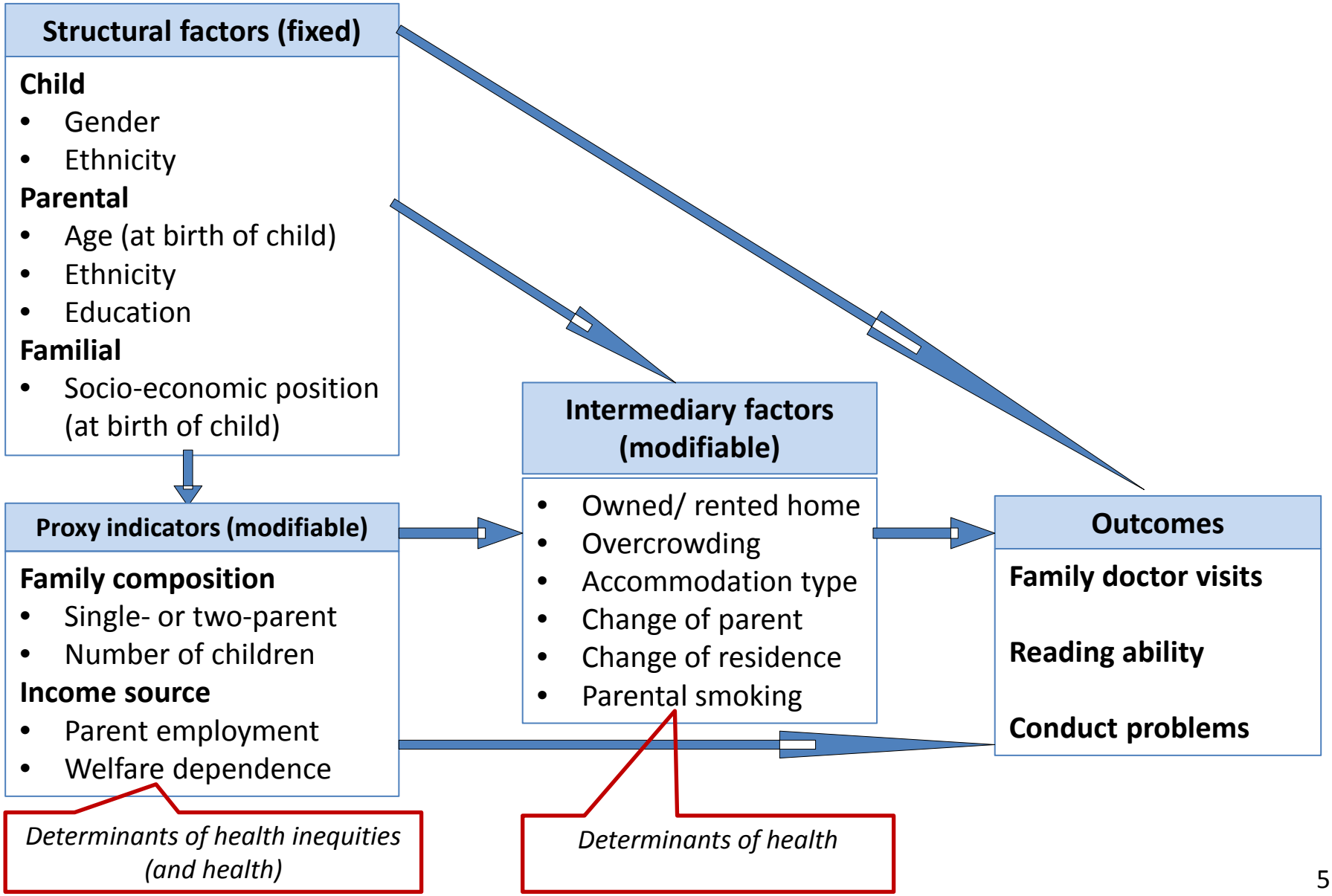
New Zealand
The University of Auckland

What is MEL-C?

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- MEL-C = Modelling the Early Life Course
- 5-year research project (2008-13) funded by Ministry of Business, Innovation & Employment
- Build a dynamic microsimulation model
- In this simulation, use longitudinal data on a birth cohort (Christchurch Health & Development Study)

Model of structural and intermediary influences on child outcomes



Research questions

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- What is the effect of improving various factors (potential determinants) on levels of child GP visits?
  - Single or multiple factors?
  - Are structural or intermediary factors more influential?
  - Is there greater impact on socially disadvantaged groups?
- Do the same mechanisms operate for outcomes in other domains, e.g. reading ability or conduct problems?

Questions

- Section 1 (Rationale)
  - What is MEL-C?
  - Conceptual model
  - Research questions
  - Determinants and outcomes

Outline

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

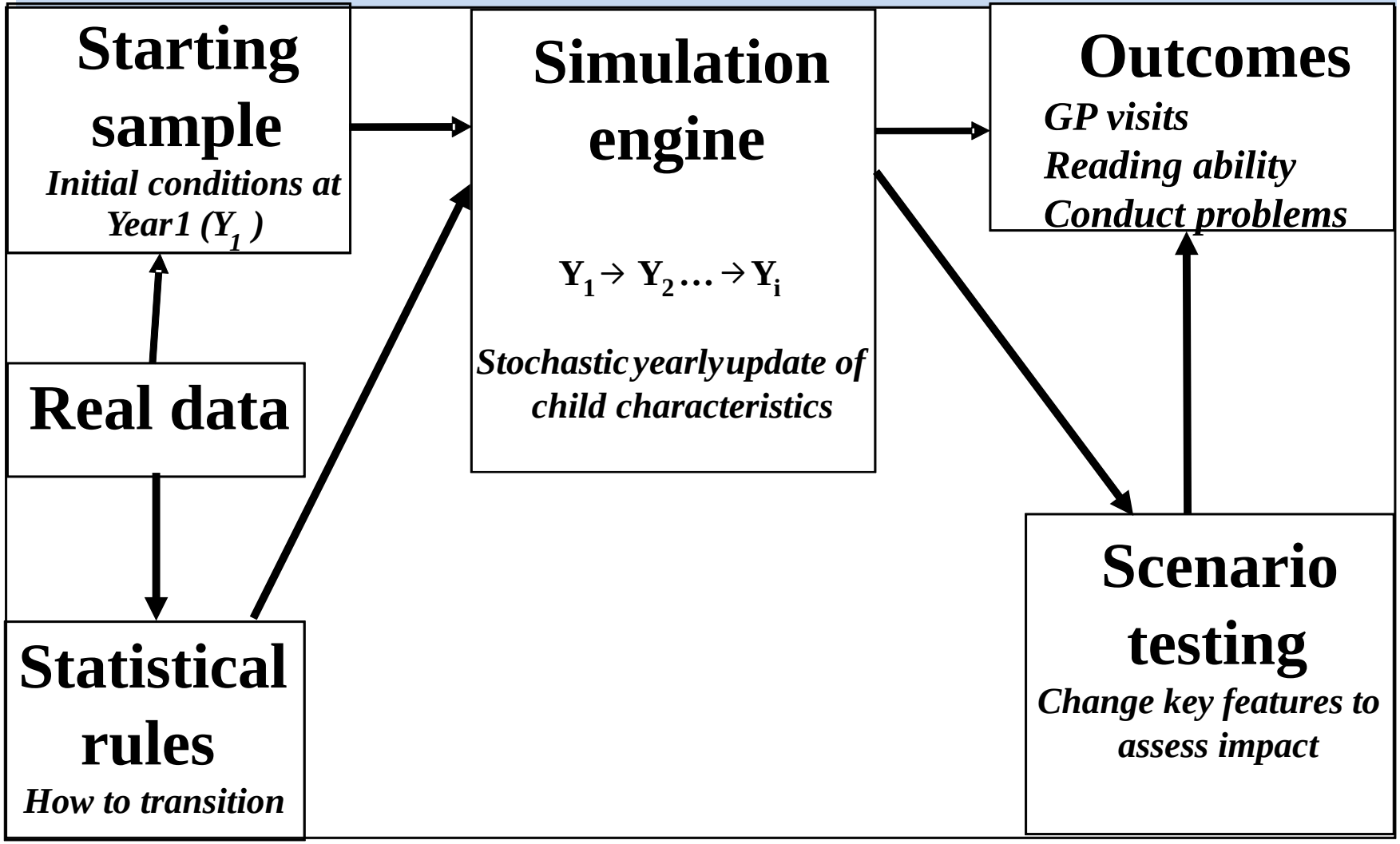
- Section 1 (Rationale)
  - What is MEL-C?
  - Conceptual model
  - Research questions
  - Determinants and outcomes
- **Section 2 (Method)**
  - **Microsimulation**
- Section 3 (Policy application)
  - Scenario testing: Base and counterfactuals
  - Conclusion

Microsimulation:
A virtual laboratory

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- **Start with a sample of children**
  - In this experiment - based on Christchurch Health & Development Study (CHDS)
- **Derive statistical rules from CHDS**
- **Apply rules to starting sample to reproduce CHDS patterns**
  - A sample of children with typical biographies
- **We have created a virtual world (our simulation model)**
- **Predict what might happen if conditions were to change**
  - Change the sample or rules, i.e. experiment with counterfactual settings and observe potential outcomes

The dynamic micro-simulation model



Validation of base simulation

Year	Real cohort (CHDS) n=1017	Virtual cohort (simulated) n=1017	Absolute error	Absolute error / CHDS mean
	GP visits (mean (95% CI))			
1	5.82	5.82 (real)		
2	5.34	5.28		
3	3.31	3.18		
4	3.13	3.15		
5	3.22	3.12		
6	3.35	3.32		
7	2.43	2.41		
8	2.14	2.15		
9	1.96	1.90		
10	1.65	1.68		
All years	**3.24**	**3.20** ***(3.15-3.25)***	**0.04**	**1.2%**
	Reading ability: BURT score (mean (95% CI))			
8	45.2	45.3		
9	54.4	54.7		
10	64.1	63.7		
11	72.8	71.9		
12	79.5	78.9		
13	85.2	84.6		
All years	**66.9**	**66.5** ***(65.7-67.4)***	**0.4**	**0.6%**
	Misconduct problems (mean (95% CI))			
6	10.6	10.6		
7	24.6	24.8		
8	24.4	25.0		
9	24.7	25.3		
10	24.9	25.6		
All years	**21.8**	**22.3** ***(22.1-22.4)***	**0.5**	**2.3%**

Questions

- Section 2 (Method)
  - Microsimulation

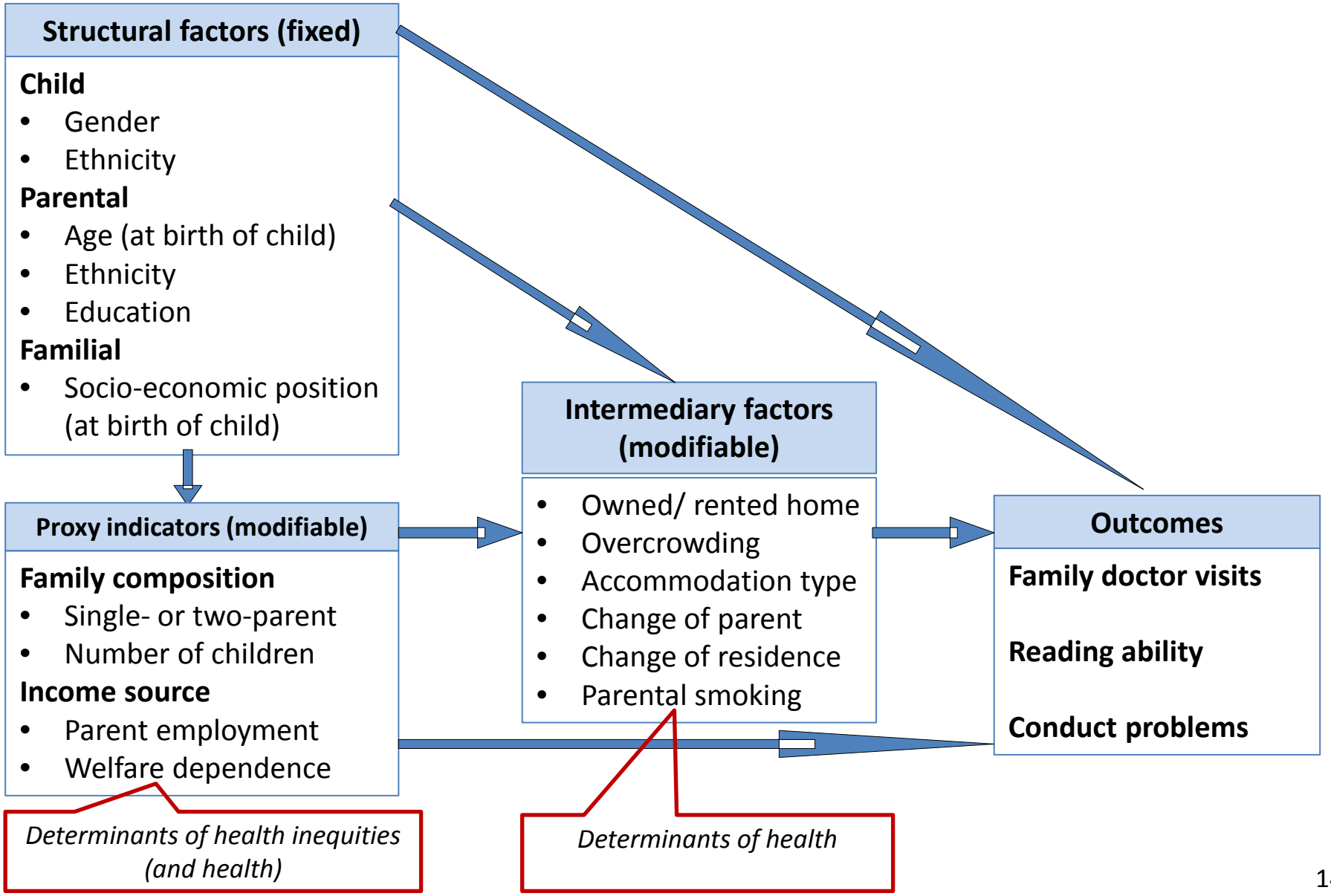
Outline

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- Section 1 (Rationale)
  - What is MEL-C?
  - Conceptual model
  - Research questions
  - Determinants and outcomes
- Section 2 (Method)
  - Microsimulation
- **Section 3 (Policy application)**
  - **Scenario testing: Base and counterfactuals**
  - **Conclusion**

New Zealand
The University of Auckland

Model of structural and intermediary influences on child outcomes



Scenario testing

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- Base simulation (status quo) vs 'improvement' simulation – modifying factors in a direction expected to advantage people, e.g. father employed, family not welfare dependent

- GP visits: increasing number of visits per year –

  interpreted as increasing access (secondary prevention, less hospitalisation)

- Reading ability: raising BURT score

- Conduct problems: reducing number

Scenario testing procedure

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

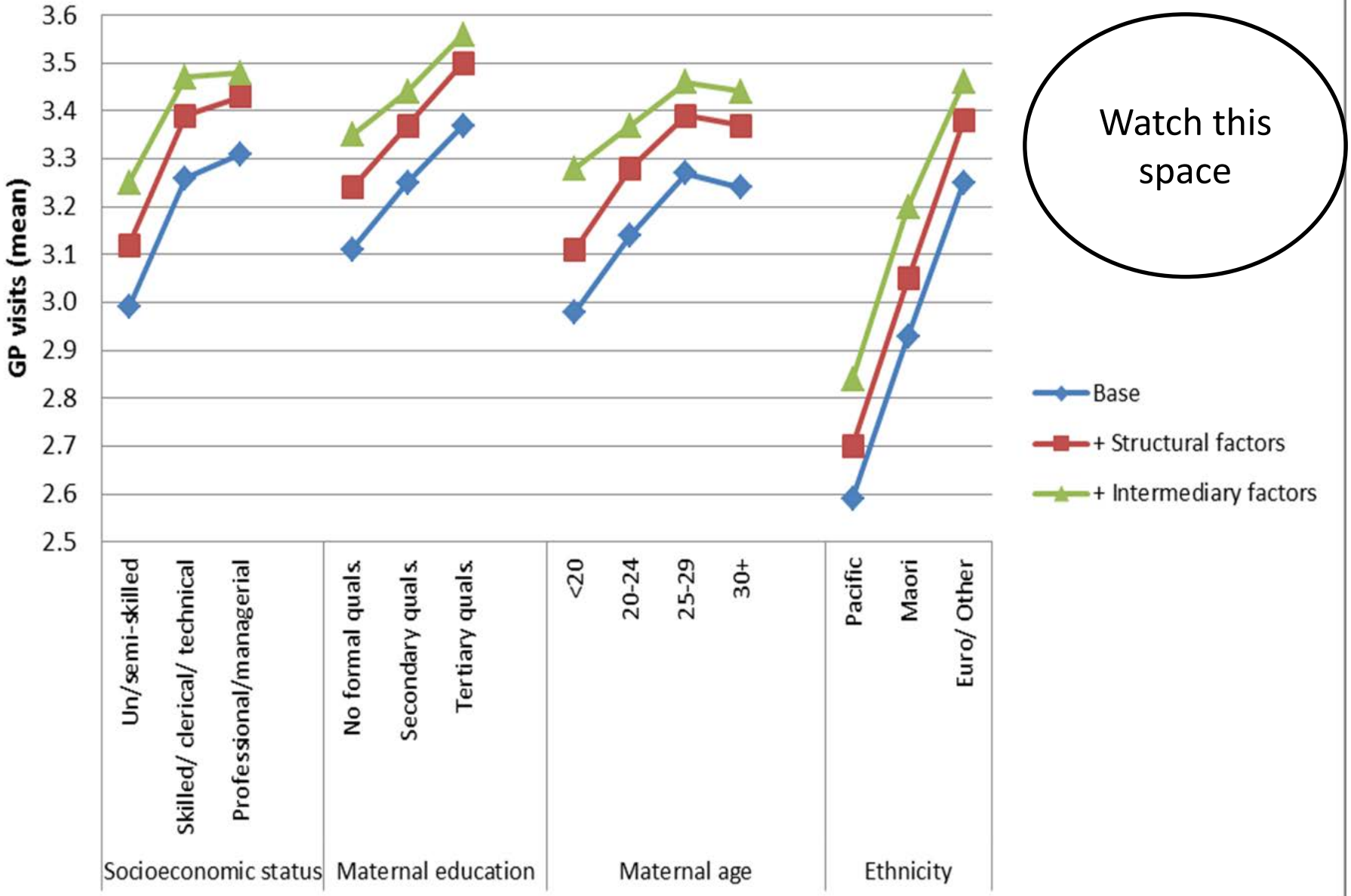
1. We 'improved' *single* factors and assessed the degree of impact on outcome
2. We 'improved' *multiple* factors simultaneously
3. We compared the relative effects of 'improving' structural and intermediary factors
4. We posed 'best case scenarios' by 'improving' structural and intermediary factors *simultaneously*

GP visits: Determinants

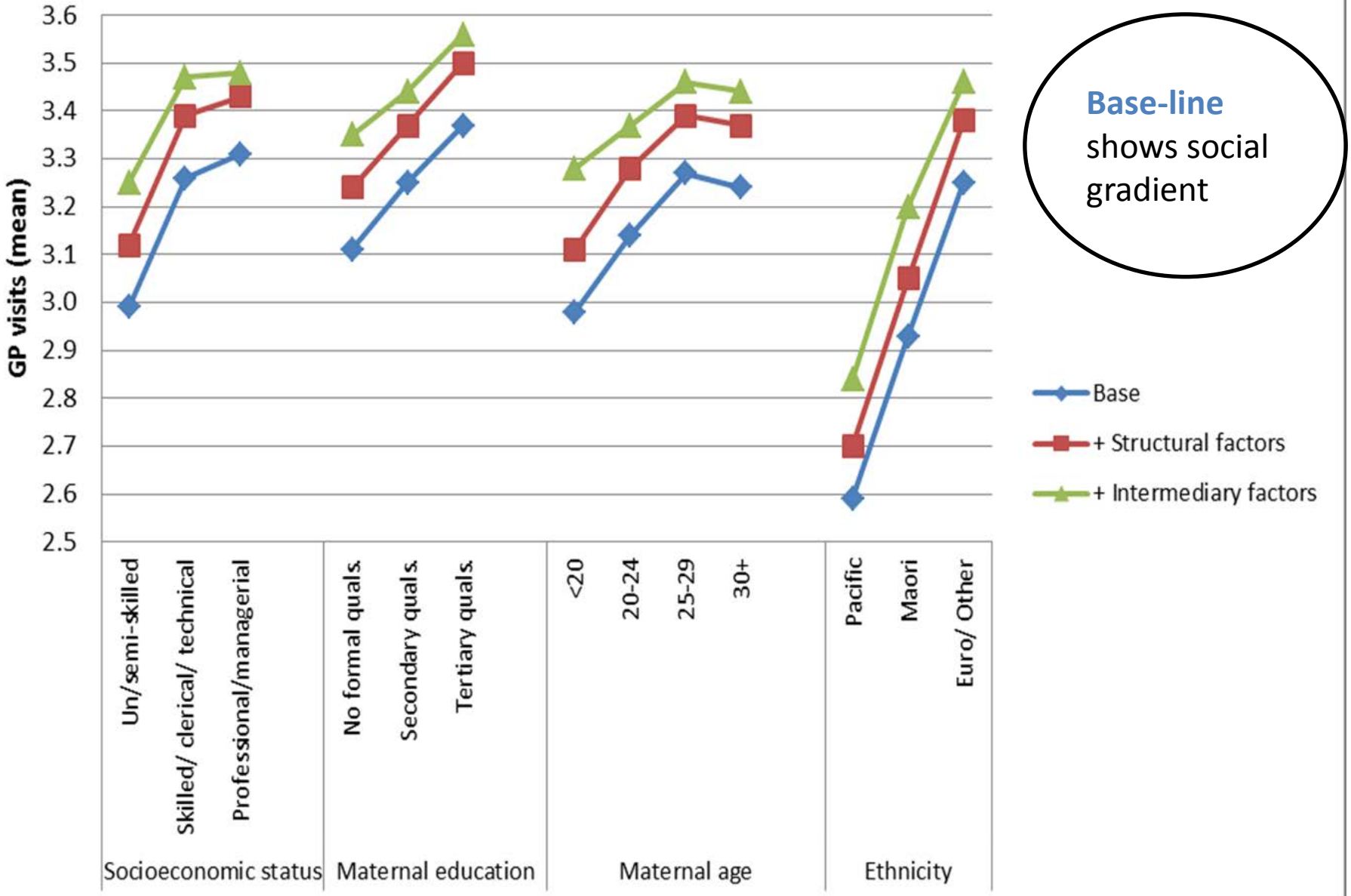
Scenarios	GP Visits (years 1-10) n=1017	
	Mean p.y.	% change
1. Base	3.20	
2. Improve structural factors only		
Fewer children	*3.31*	*+3.4%*
ALL	3.33	+4.1% *
3. Improve intermediary factors only		
Own home	*3.26*	*+1.9%*
ALL	3. 28	+2.5%
4. Best scenario: Improve both structural and intermediary factors	3.41	+6.6% *

* p<0.05

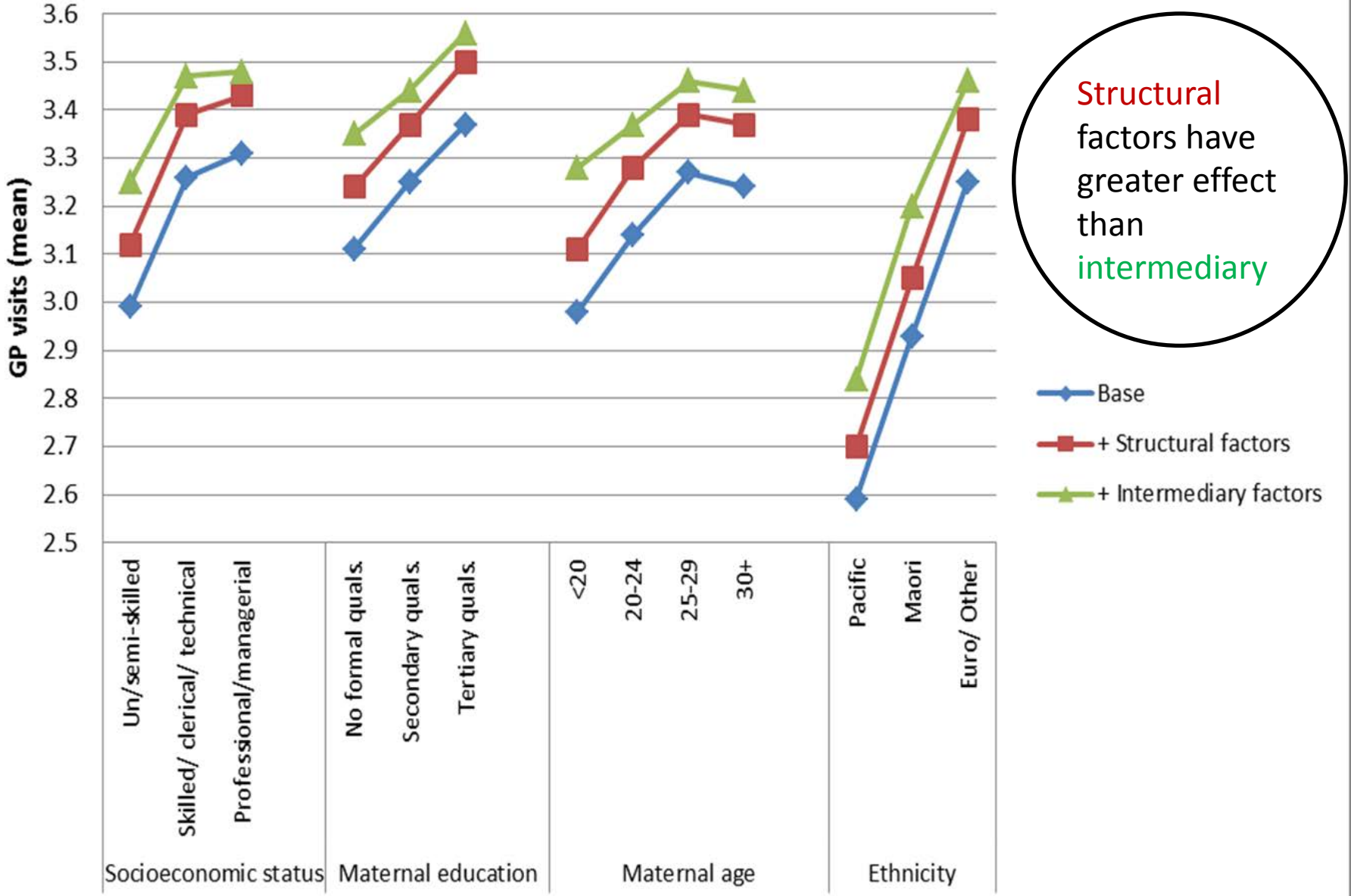
GP Visits. Disparities: absolute change



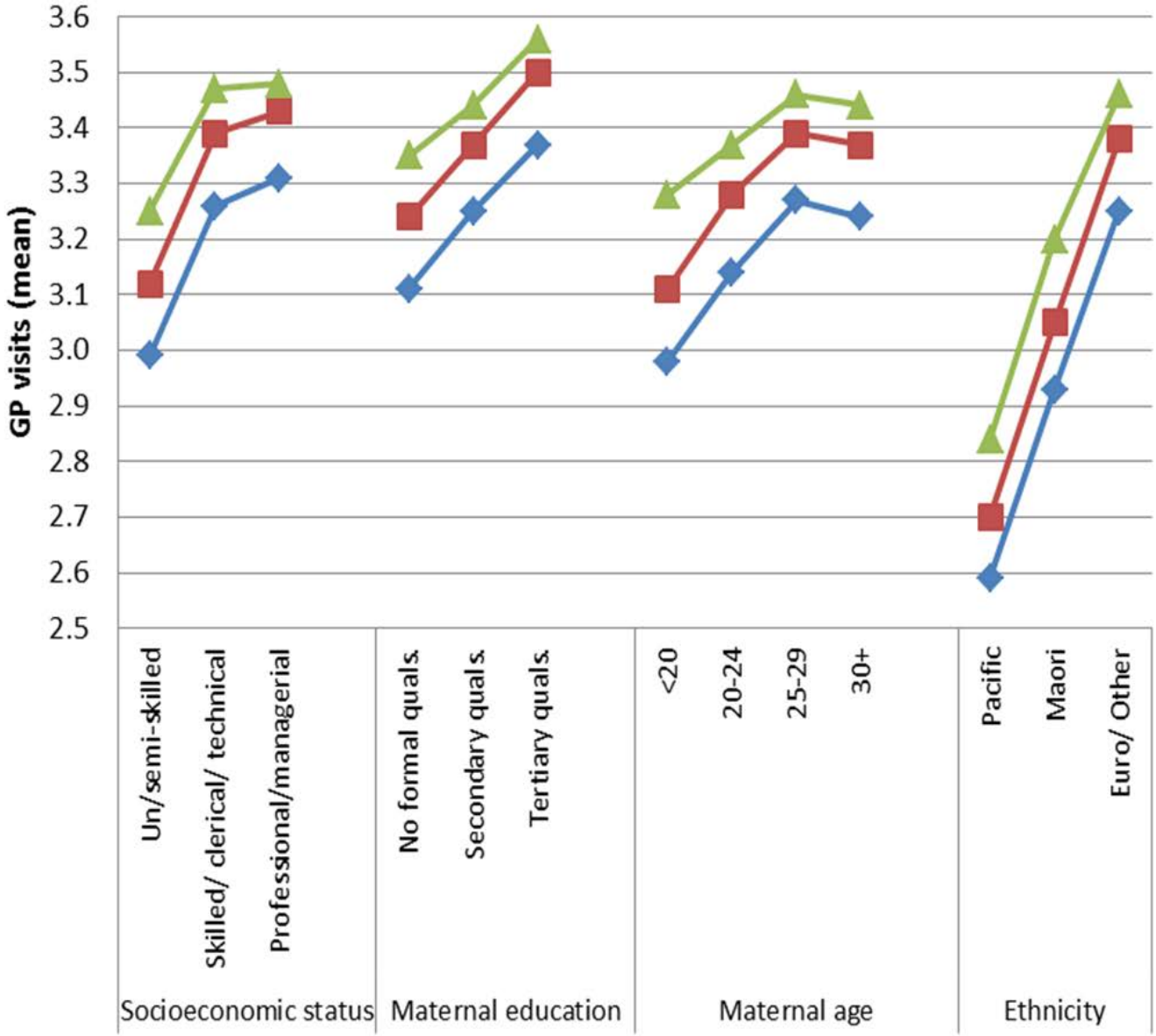
GP Visits. Disparities: absolute change



GP Visits. Disparities: absolute change

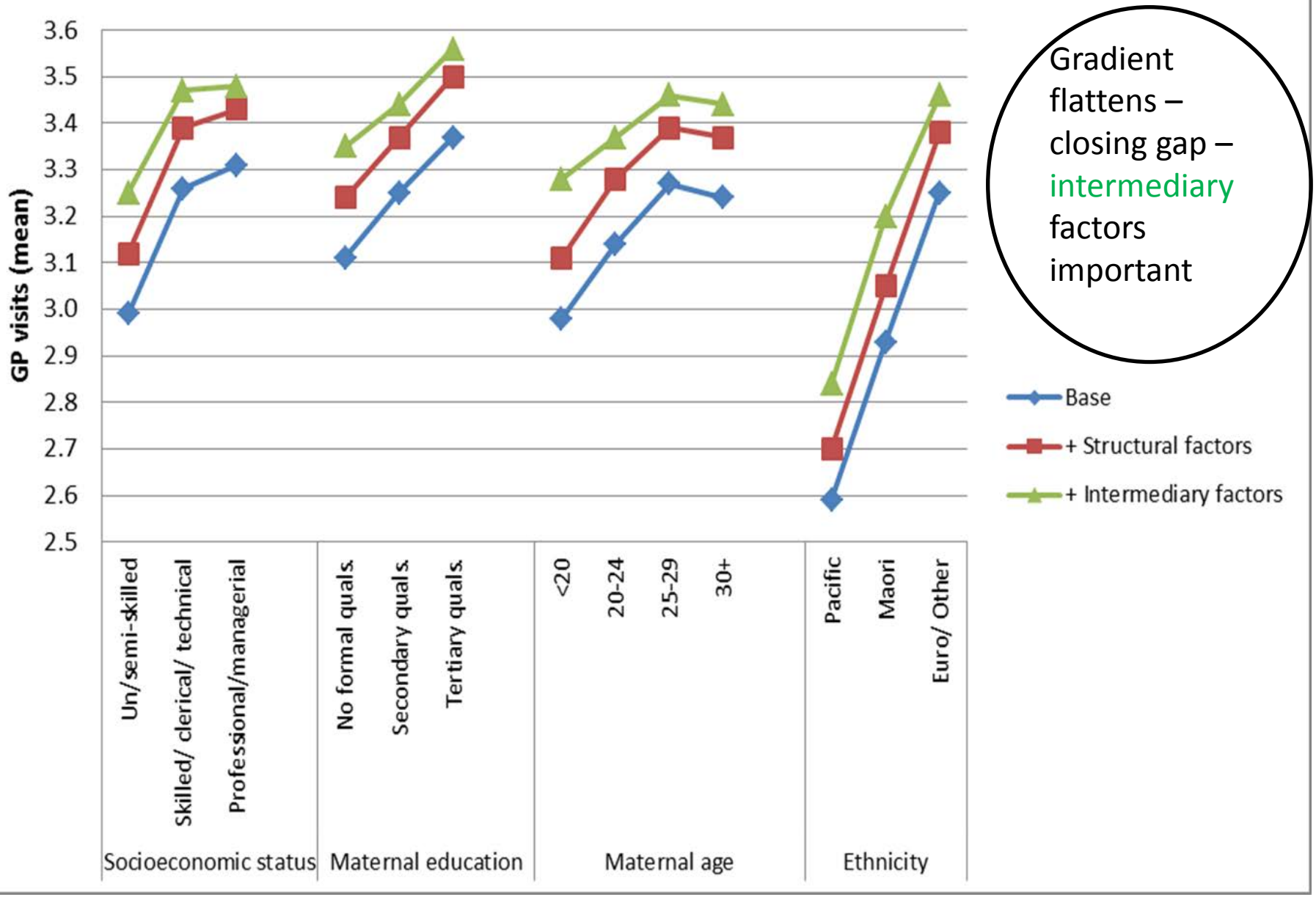


GP Visits. Disparities: absolute change



All groups benefit but more so for disadvantaged

GP Visits. Disparities: absolute change



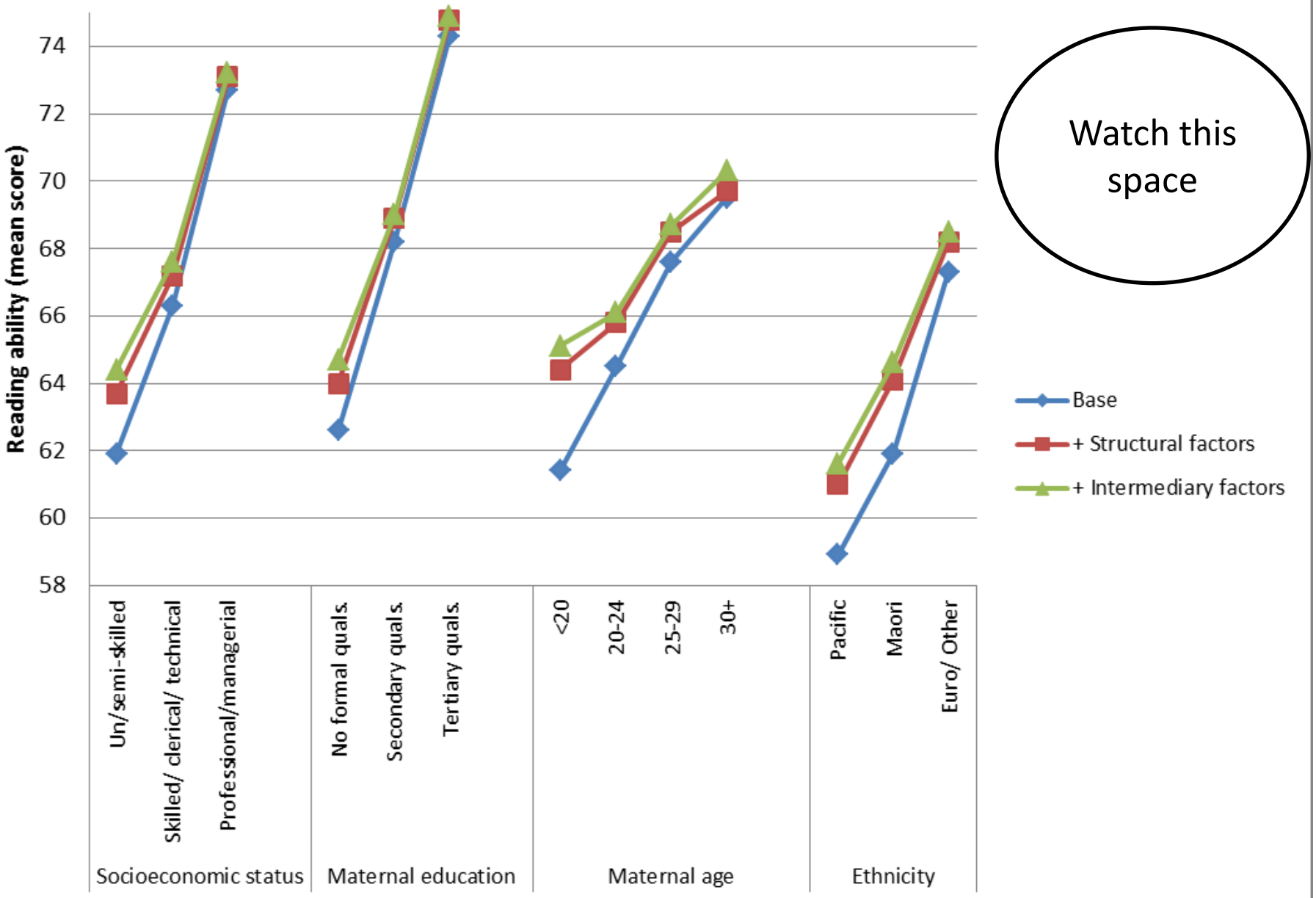
Gradient flattens – closing gap – intermediary factors important

Reading ability: Determinants

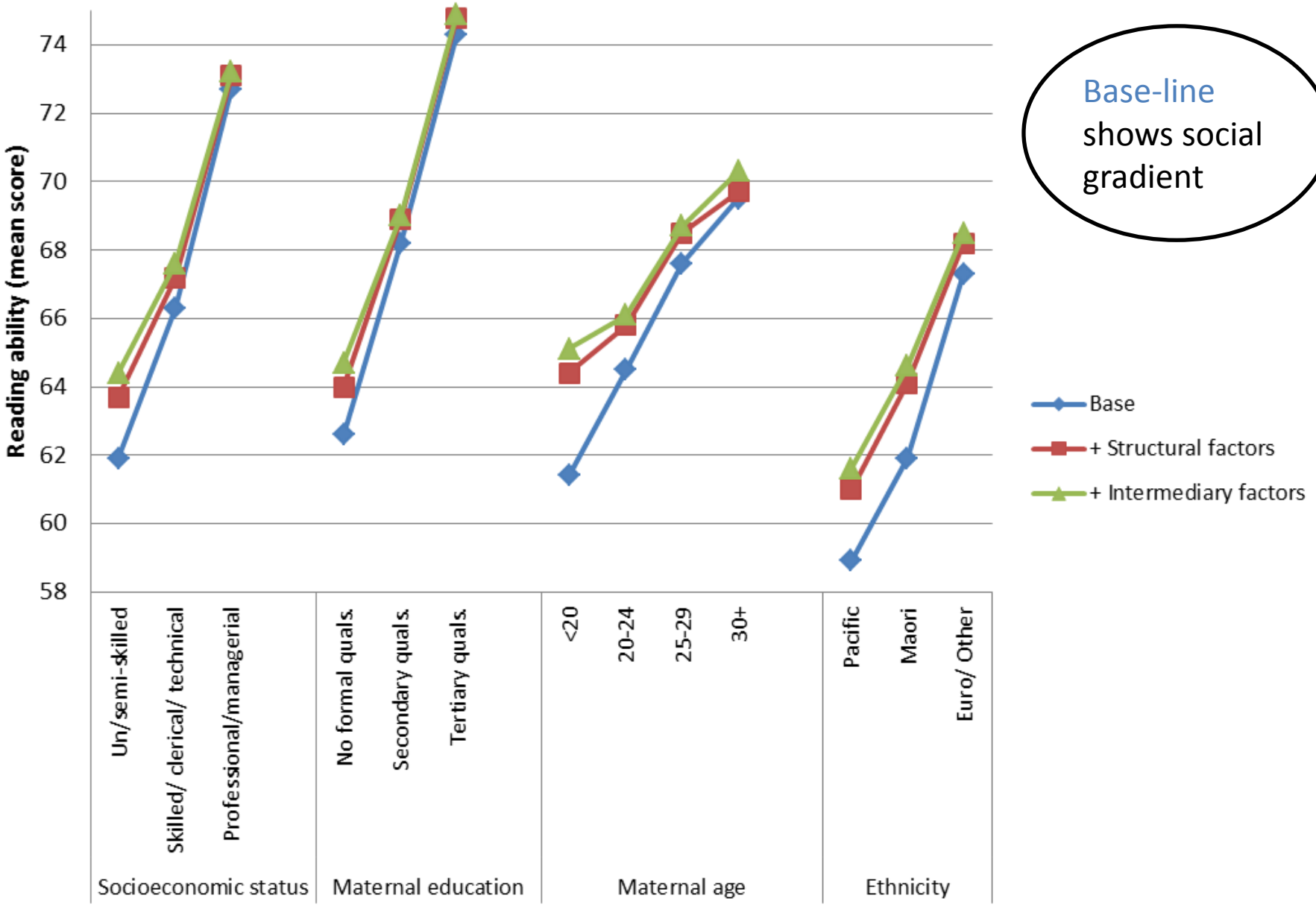
Scenarios	Reading Ability (years 8-13)	
	Mean	% change
1. Base	66.5	
2. Improve ALL structural factors only	67.6	+1.7
3. Improve ALL intermediary factors only	67.1	+0.9
4. Best scenario: Improve both structural and intermediary factors	67.9	+2.1

* $p<0.05$

Reading Ability. Disparities: absolute change

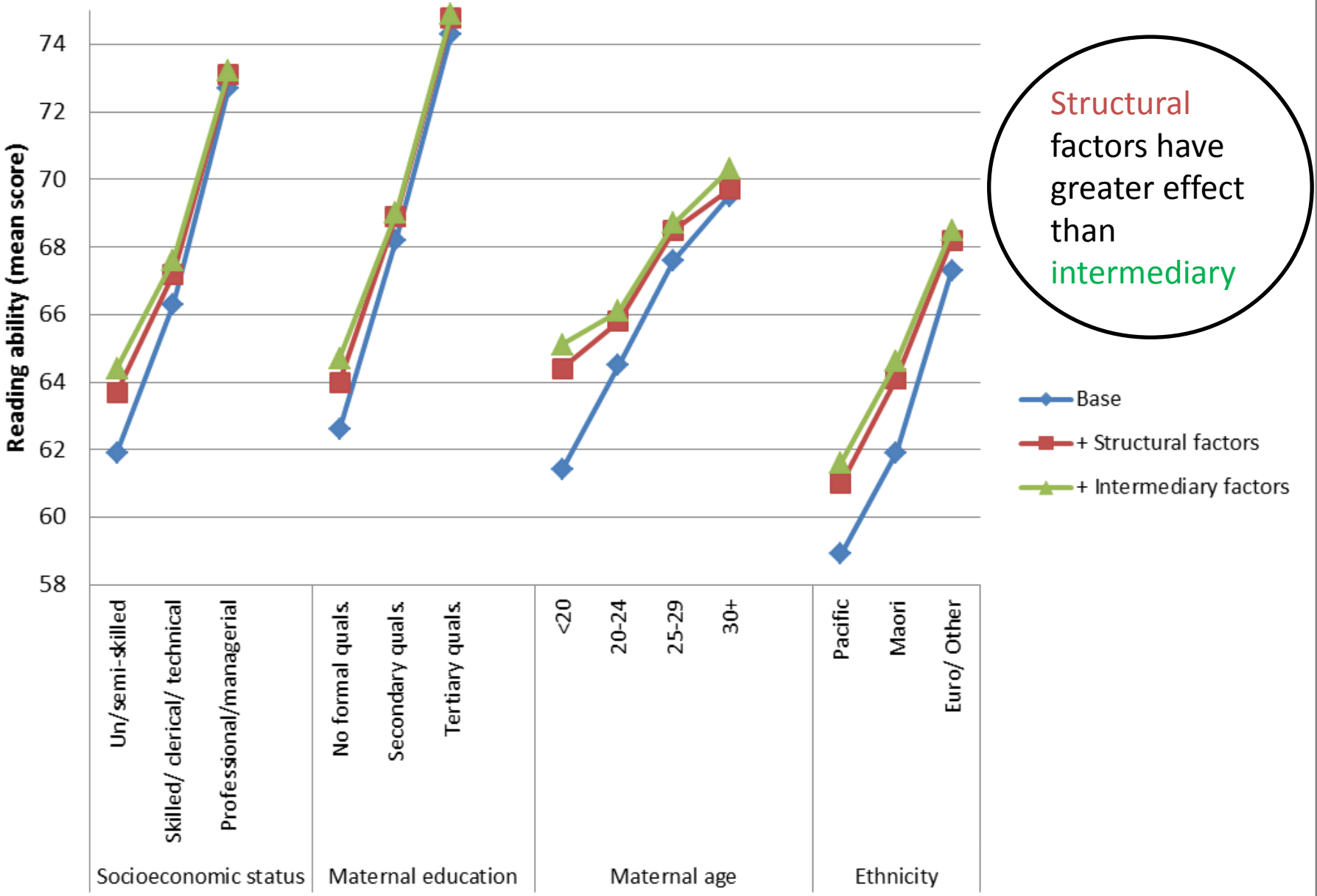


Reading Ability. Disparities: absolute change

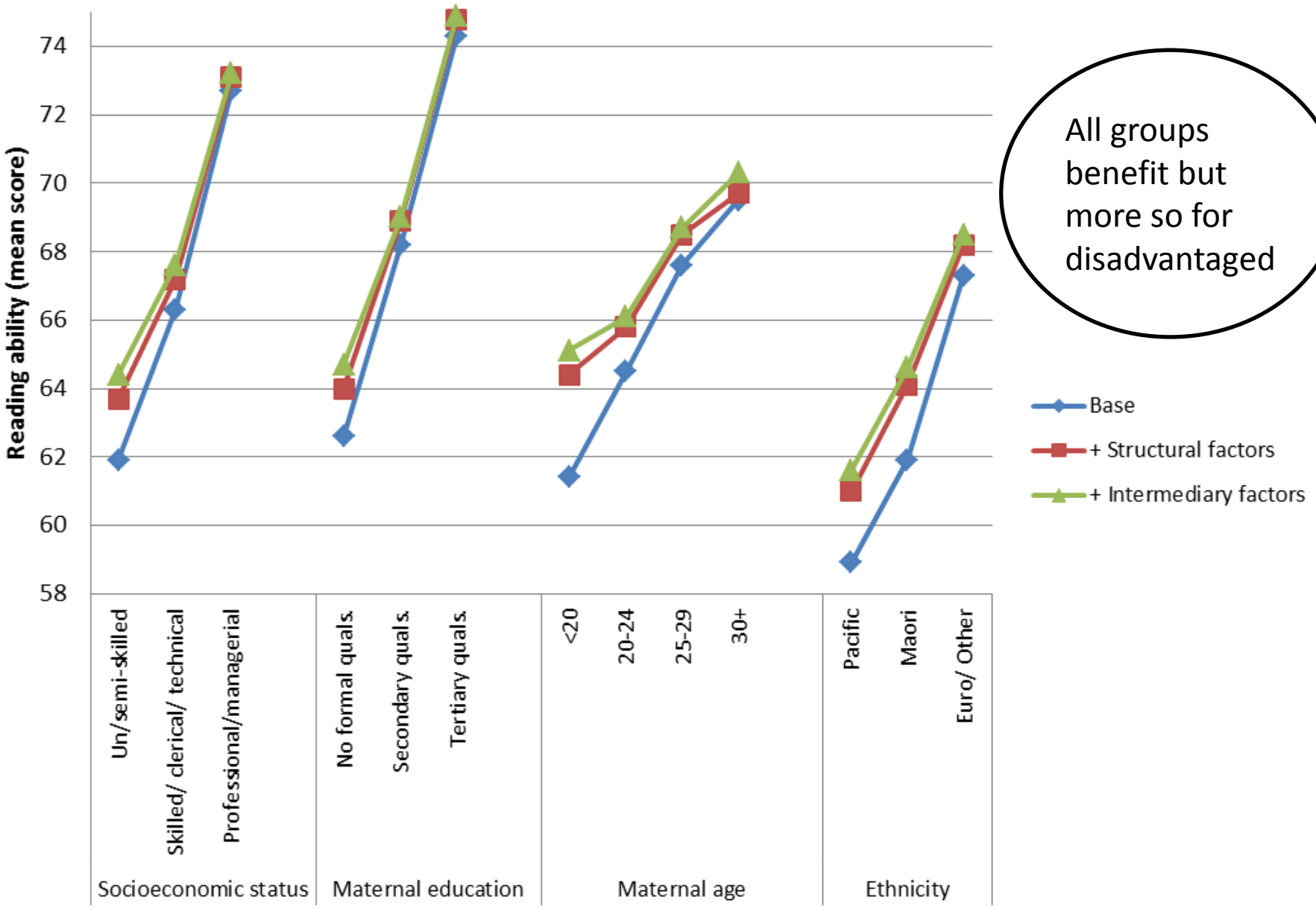


Base-line shows social gradient

Reading Ability. Disparities: absolute change

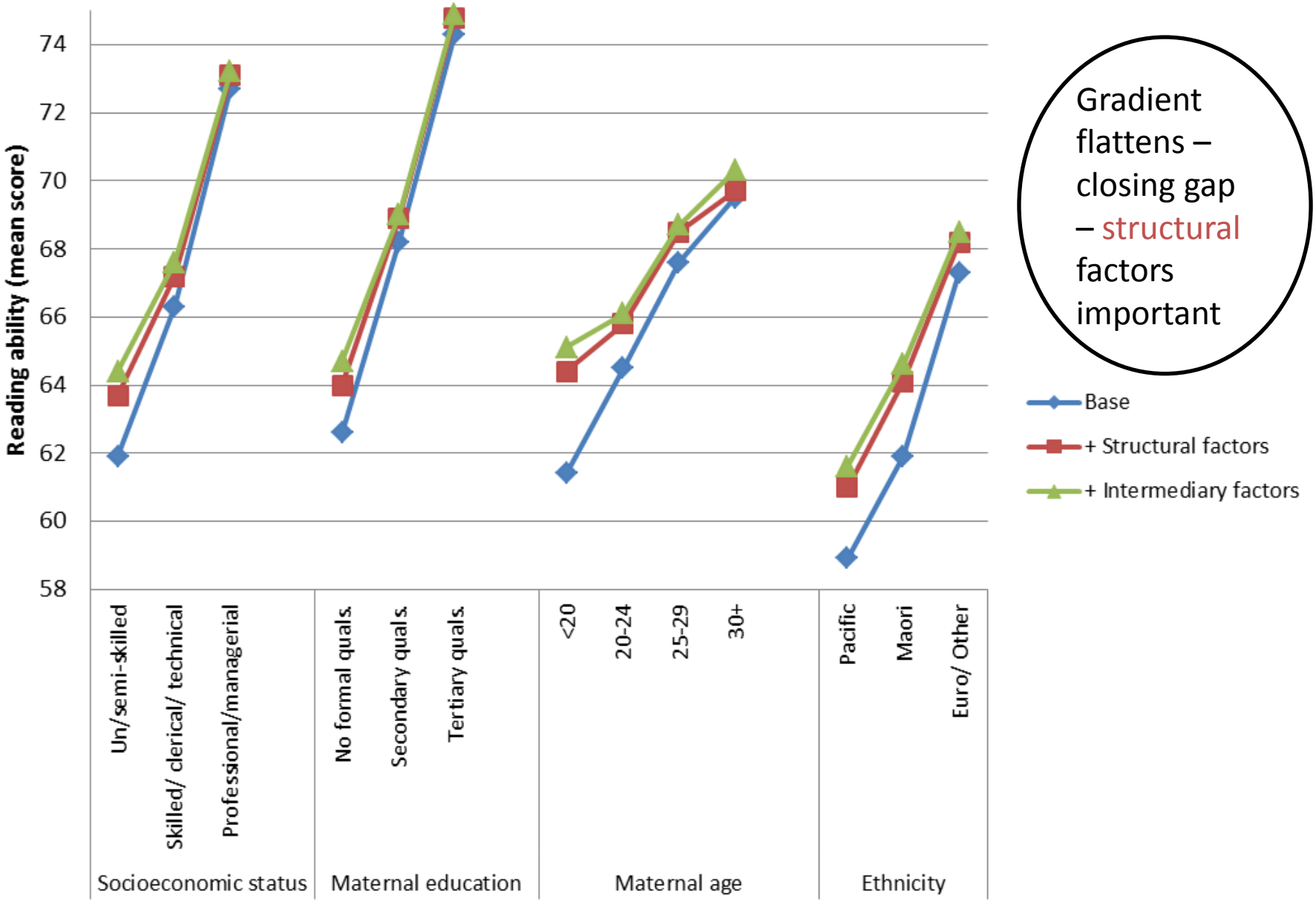


Reading Ability. Disparities: absolute change



All groups benefit but more so for disadvantaged

Reading Ability. Disparities: absolute change

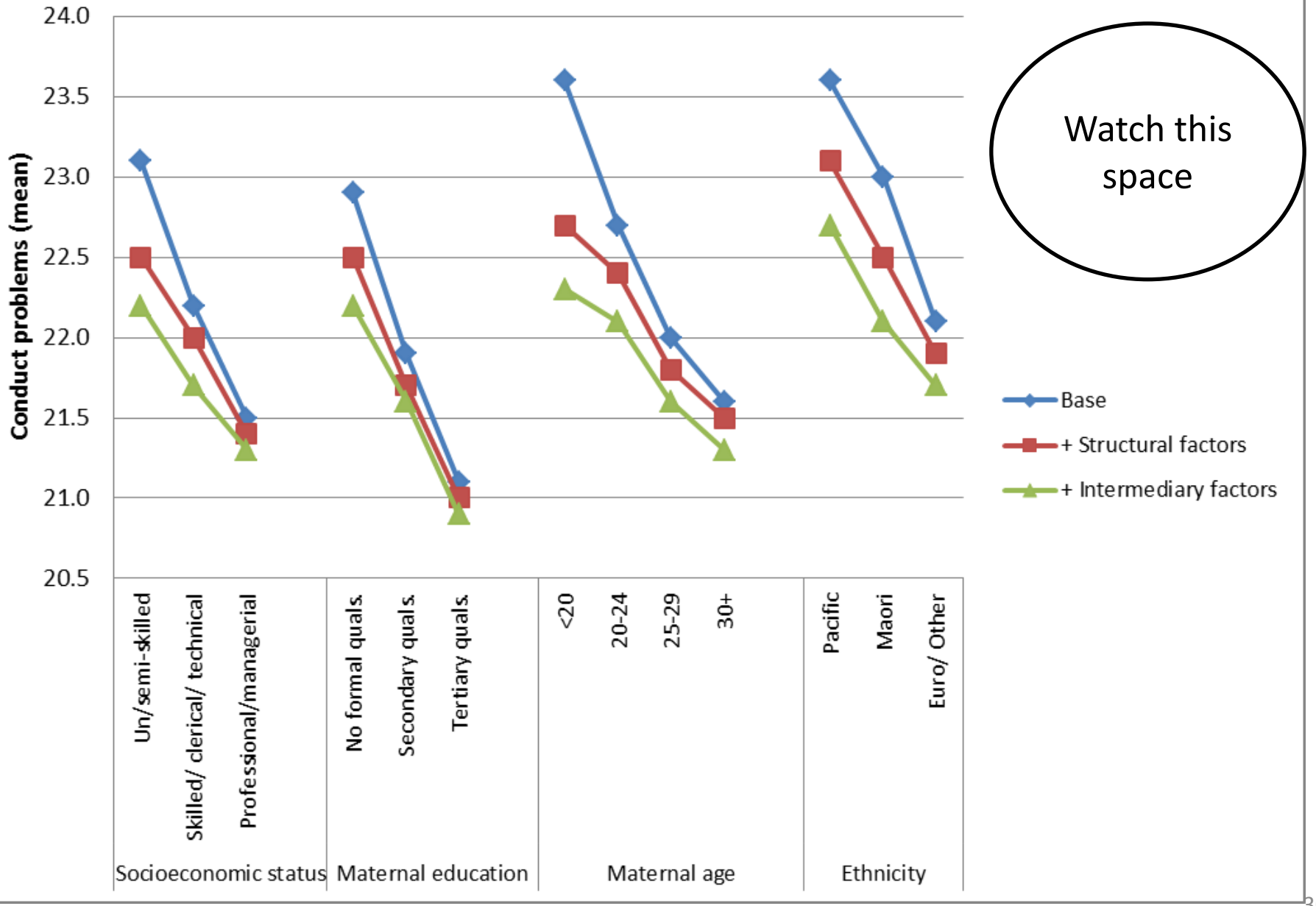


Conduct problems: Determinants

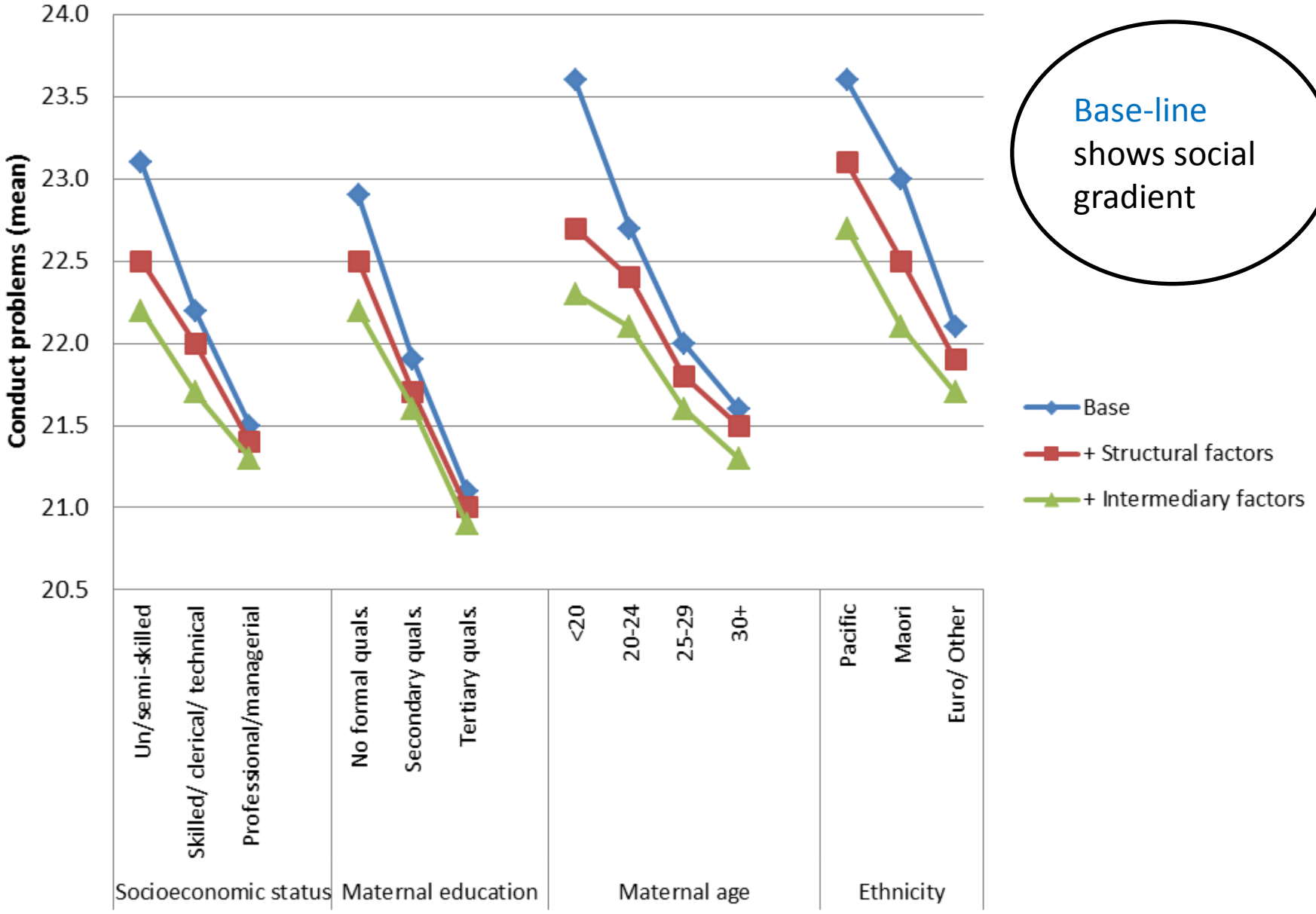
Scenarios	Conduct problems (years 6-10)	
	Mean	% change
1. Base	22.3	
2. Improve ALL structural factors only	22.0	-1.3
3. Improve ALL intermediary factors only	22.0	-1.3
4. Best scenario: Improve both structural and intermediary factors	21.8	-2.2*

* $p<0.05$

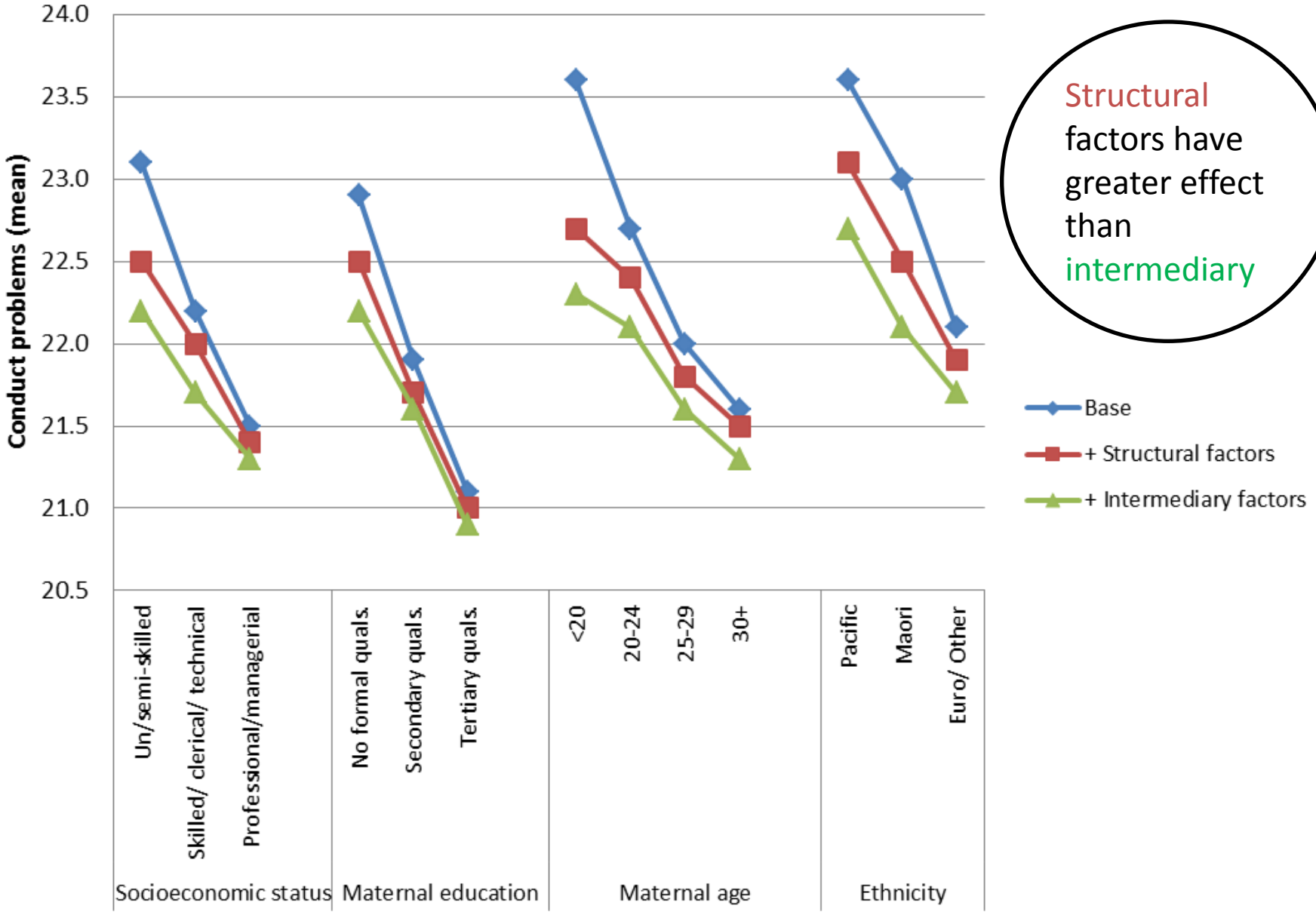
Conduct Problems. Disparities: absolute change



Conduct Problems. Disparities: absolute change

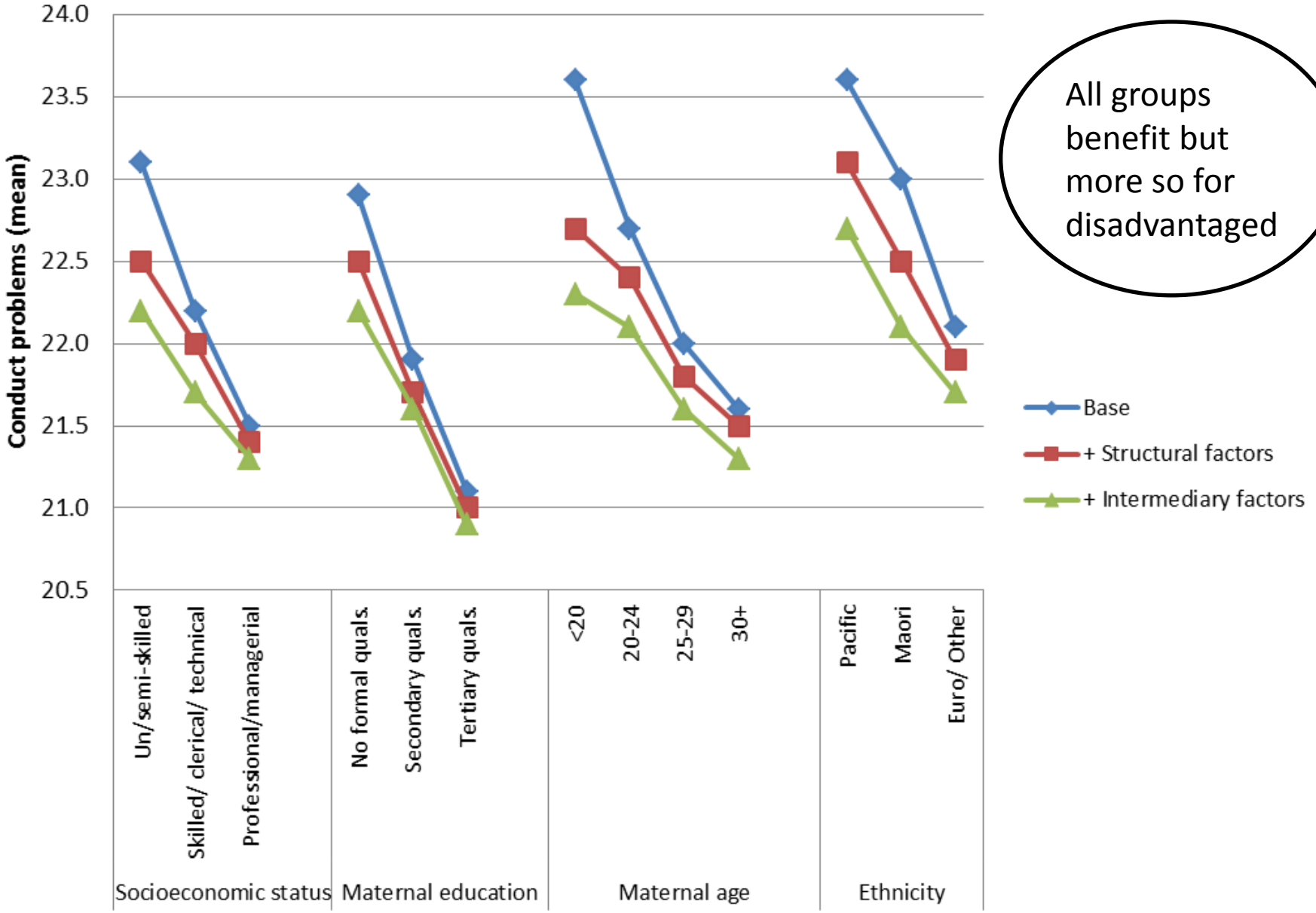


Conduct Problems. Disparities: absolute change



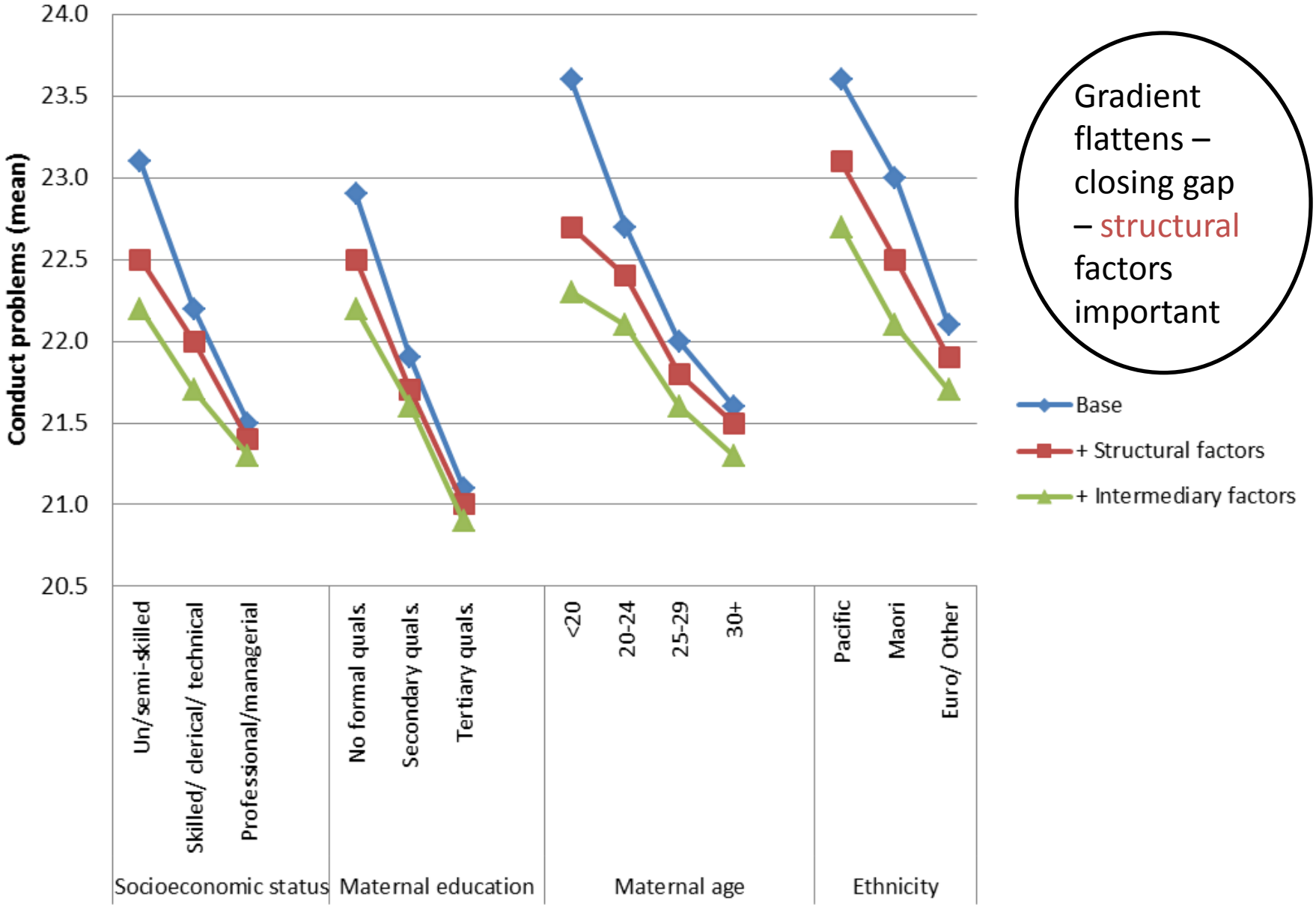
Structural factors have greater effect than intermediary

Conduct Problems. Disparities: absolute change



All groups benefit but more so for disadvantaged

Conduct Problems. Disparities: absolute change



Summary of results

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

Empirical model to inform likely policy and action

- Q1: Changing a single factor has slight effect on outcome - appreciable effect only by changing multiple factors
- Q2: Effect of modifiable structural factors is greater than of intermediary factors
- Q3: Clear social gradients with differential positive effects on outcome according to level of disadvantage
- Q4: Similar findings for range of outcomes in different domains

Conclusion

COMPASS RESEARCH CENTRE
FACULTY OF ARTS
THE UNIVERSITY OF AUCKLAND
Whare Wānanga o Tāmaki Makaurau

- Social determinants of health framework – tackling disparities
- Simulation model – useful for counterfactual modelling
- Policy implications
  - Important to tackle multiple determinants, esp. structural
    – argues for inter-sectoral policy?
  - Social gradients of impact – more disadvantaged groups gain more benefit
    – argues for progressive universalism?
- Can public policy make a difference to the most disadvantaged? … Yes it can!

Questions

- Section 3 (Policy application)
  - Scenario testing: Base and counterfactuals
  - Conclusion
- Anything else?