Otago Spotlight Series

Cardiovascular Disease

Modelling Dietary Sodium Reductions & Abdominal Aortic Aneurysm Screening

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Dietary salt interventions – contributing to a NZ league table

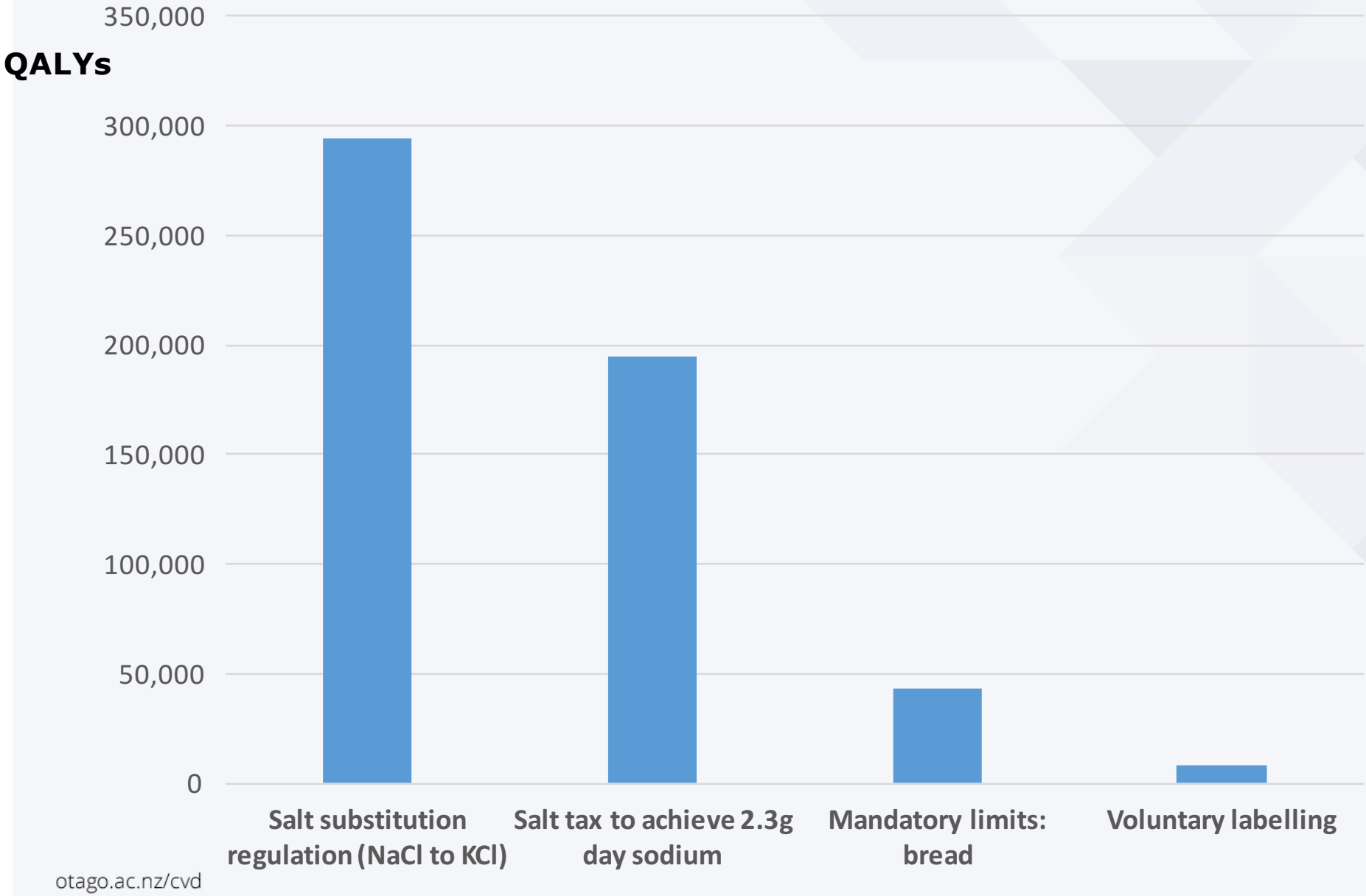
- Dietary salt → blood pressure → heart disease & stroke
- NZ mainly uses: counselling; Tick Programme
- Other countries:
  - Media campaigns (eg, UK)
  - Maximum levels in foods (eg, bread: EU countries)
  - Taxing salty foods (eg, Hungary)
  - Encouraging industry to reformulate food (eg, UK)
  - Substitution with KCl (eg, Finland)

Methods (sodium reduction)

- Markov macro-simulation model (in TreeAge, with comparison made with MSLT model)
- Estimates QALYs gained (↓CHD & ↓stroke)
- Estimates net health system costs (life course)
- Population: 2.3 m NZ adults, aged 35+
- Health system perspective
- Discounting of QALYs & costs at 3% per annum
- Online Reports: Model validation, background to interventions

Selected interventions & QALYs gained in NZ adults

(Ngheim et al 2015 *PLoS One*, Nghiem et al 2016 *BMC Public Health*)



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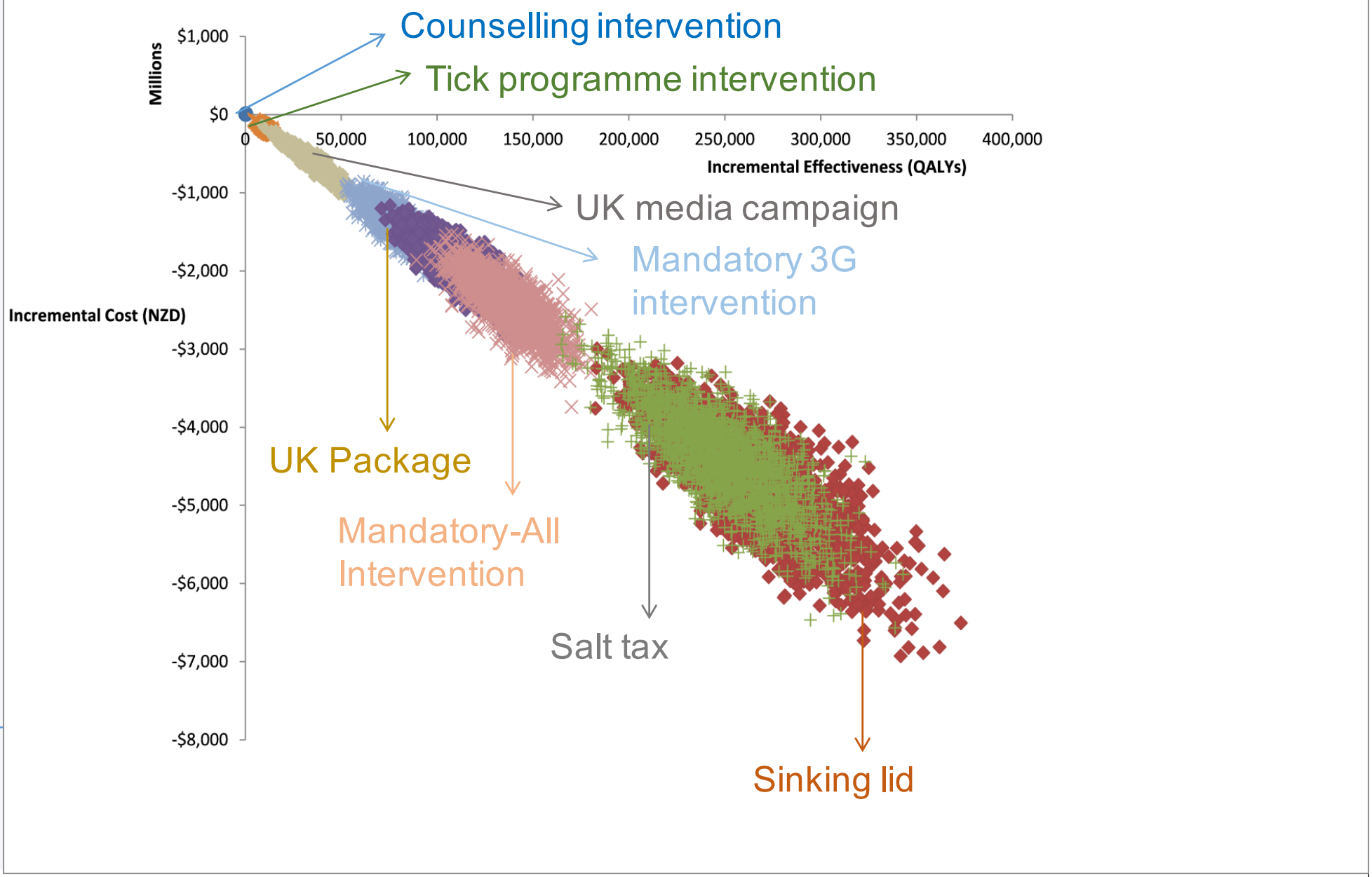
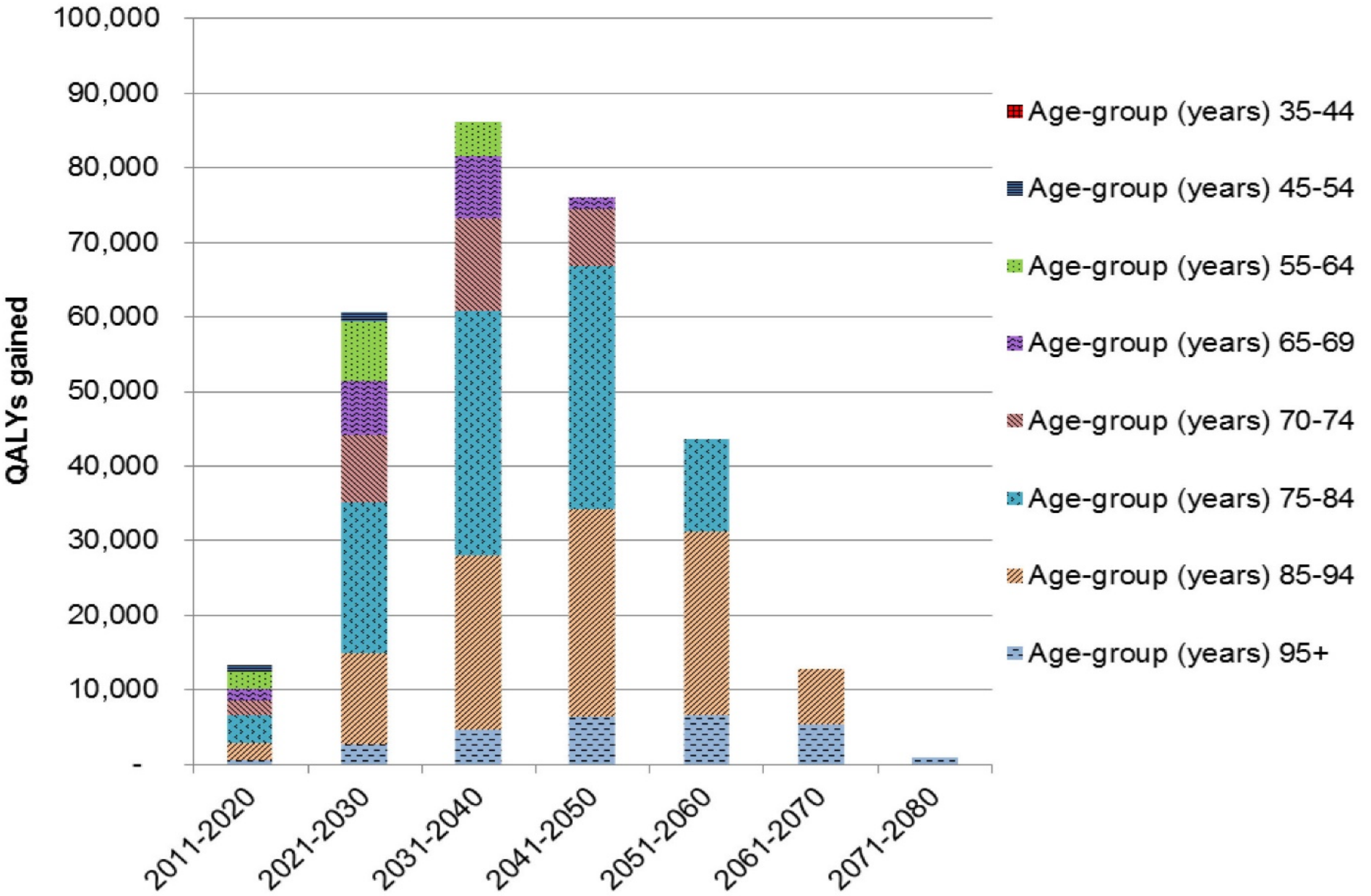
Building up a league table – QALYs, cost savings, cost-effectiveness

Modelled intervention	Health gain (QALYs for remainder of the cohort's life)	Health system cost (NZ$; millions) for remainder of the cohort's life	Incremental cost-effectiveness ratio (ICER)
1) Salt substitution at the 59% level (processed food)	294,000	-1500	Dominant
2) "Sinking lid" for salt supply to the market	211,000	-1110	Dominant
3) Salt tax	195,000	-1000	Dominant
4) Salt substitution at 25%	121,000	-620	Dominant
5) Mandatory 25% reduction of sodium in all processed foods ("Mandatory-All")	110,000	-600	Dominant
6) UK Package (media campaign and voluntary action by industry)	85,100	-440	Dominant
7) Mandatory 25% reduction of sodium in bread, processed meats and sauces ("Mandatory-3G")	61,700	-340	Dominant
8) Tight limits on sodium in bread (280 mg/100 g)	43,500	-220	Dominant
9) UK style "Mass Media Campaign"	25,200	-120	Dominant
10) Modest limits on sodium in bread (400 mg / 100 g)	15,600	-83	Dominant
11) Endorsement Label Programme (current practice in NZ)	7900	-34	Dominant
12) Dietary counselling by dietitians (current practice in NZ)	200	6.90	NZ$36,900 per QALY gained

But notable uncertainty persists [Nghiem et al 2015 PLoS One]



Who gains QALYs: mainly older NZers



Selected Issues

- Some policy-makers may want to maximise QALYs in working-age adults: sodium reduction limited value
- Pro-equity: 33% higher per capita QALY gain for Māori
- Can compare personal (counselling) with population-level interventions
- Can compare voluntary labelling (Pick the Tick) with mandatory regulations (see also re salt targets: Wilson et al 2016, *Nutr J*)
- Tax revenue from a salt tax – a potential plus, but depends on use of the revenue

A Closer Look: Salt substitution

- Various products on market: ↓NaCl & ↑KCl
- Used for decades in Finland, but modest use in NZ (eg, Continental soups)
- RCT data – 59% substitution acceptable
- Our bread design research – suggests feasibility (Wilson et al 2016 *BMC Nutrition*)

Wilson et al. BMC Nutrition (2016) 2:23
DOI 10.1186/s40795-016-0062-x

BMC Nutrition

RESEARCH ARTICLE Open Access

Designing low-cost "heart healthy bread": optimization using linear programing and 15-country comparison

Nick Wilson*, Nhung Nghiem, Sian Ryan, Christine Cleghorn, Nisha Nair and Tony Blakely

Abstract

Background: Bread is an important comp
also typically too much of other nutrients
the optimal design of low-cost "heart heal
15 countries.

Methods: Optimization using linear progr
range of minimal sodium levels. Then with
then dietary fiber, and then polyunsaturate
and comparison nutrient and price data c

Results: The optimized loaf costing NZ$1.
three out of the eight heart health nutrien
in ingredients (HHBS3), was nutritionally s

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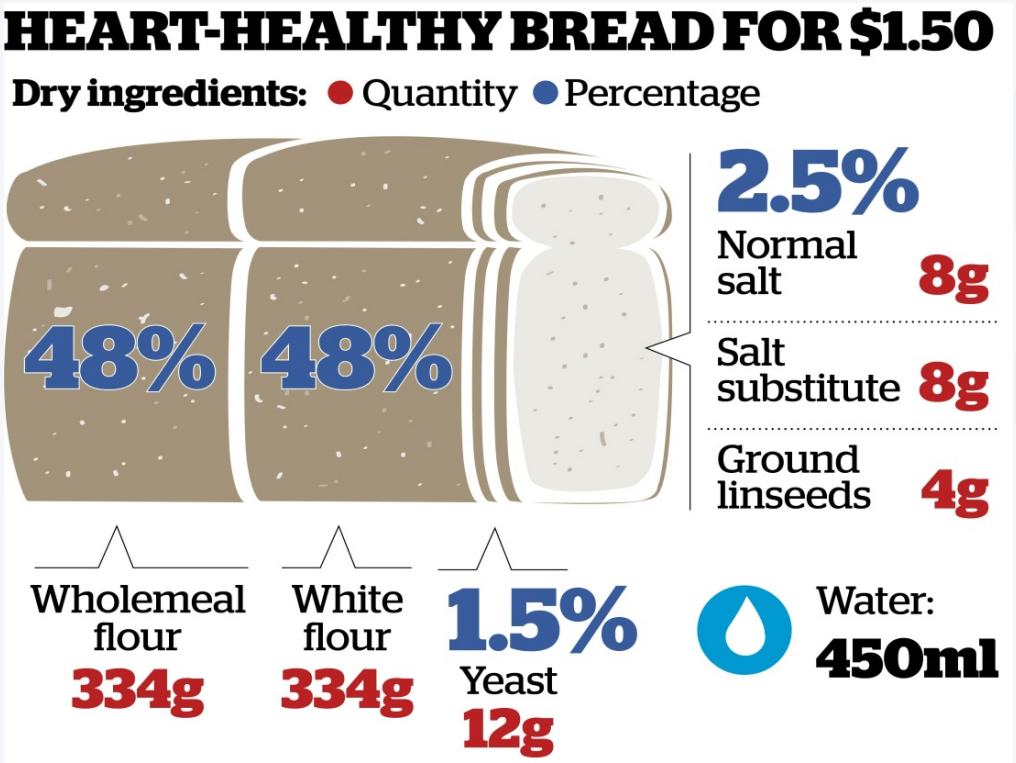
Media coverage of these bread designs: also suggests high public interest

NZ Herald **"Kiwi researchers design super-loaf"**



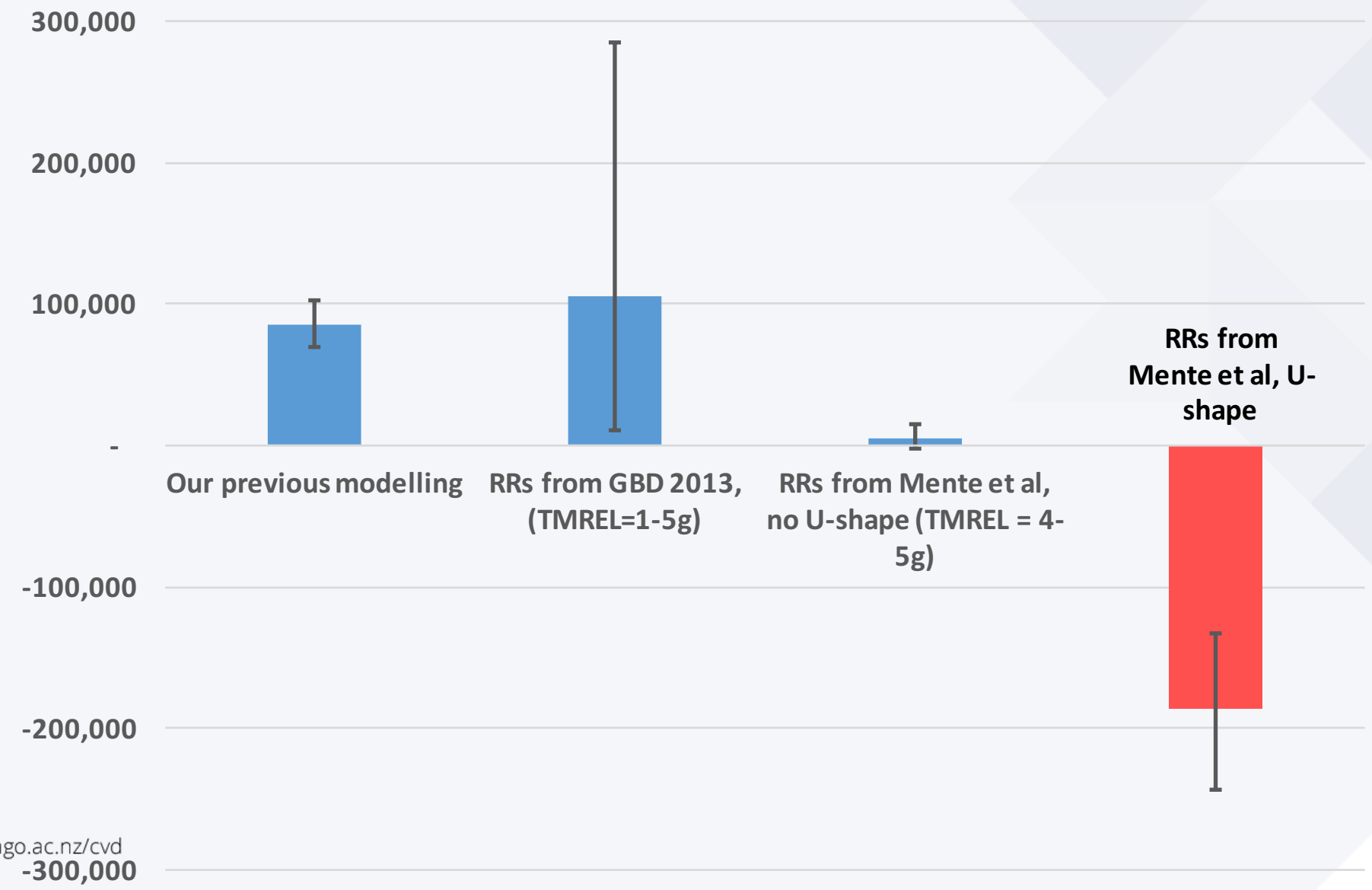
But what if sodium reduction just benefits high-intake consumers?

- Little scientific debate about risk from high intakes (>5g/d Na+, >13g/d salt)
- But recent studies: uncertainty about hazard from Na+ <5g/d. Even U-shaped association (highly disputed).
- GBD 2013: Theoretical minimum risk exposure level (TMREL) varied: Na+ 1-5g/d
- So we have started exploring these possibilities

Preliminary Results: QALYs gained (DR=3%)

Intervention	Our previous modelling	RRs from GBD 2013, (TMREL=1-5g)	RRs from Mente et al, no U-shape (TMREL=4-5g)	RRs from Mente et al, U-shape (TMREL=4-5g)
Tick Programme intervention	7900	10,200	550	-15,700
Maximum level in bread (400mg/100g)	15,600	21,500	1160	-33,500
UK package	85,100	104,900	5300	-186,000
Processed meats (mandatory 30%↓)	13,400	185,200	16,700	-27,800

UK Package (media campaign, reformulation): Preliminary Results with QALYs gained (DR=3%)

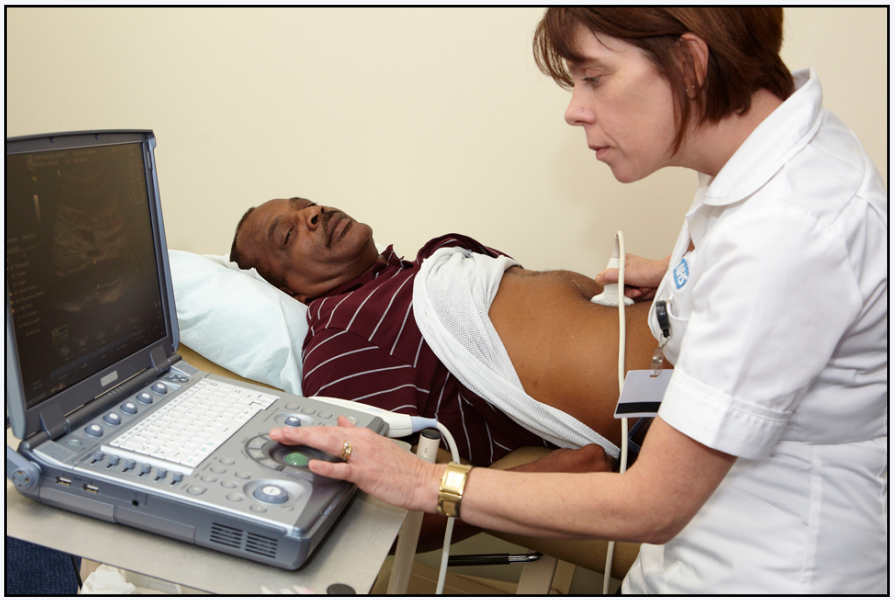


Summary: Sodium reduction

- Our modelling of many interventions – many large health gains, nearly all cost saving
- Sodium substitution – largest gains (& feasible as per bread research)
- Research to clarify TMREL & U-shape issue critical
- Policy-makers concerned about the scientific uncertainty could target interventions to high intake consumers (eg, ↓Na+ in processed meats)
- But if research confirms a U-shaped association → would need personalised targeting of sodium advice

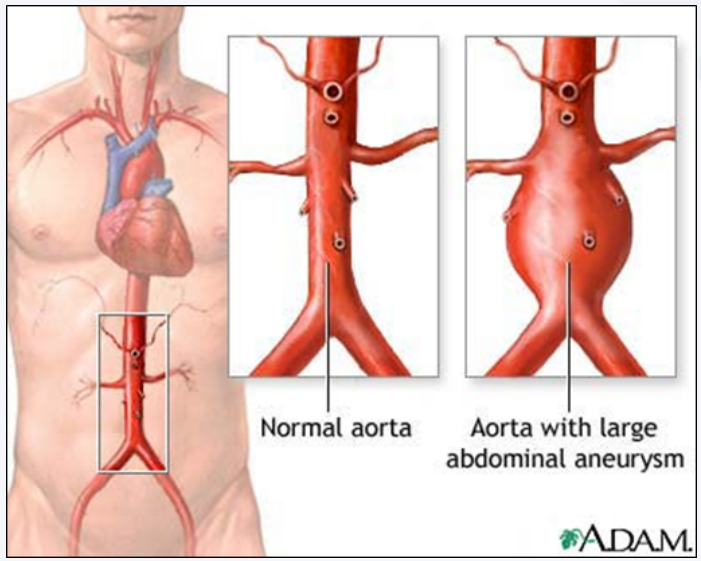
A screening program for abdominal aortic aneurysms:

Would an NHS-style AAA screening program be cost-effective in NZ?



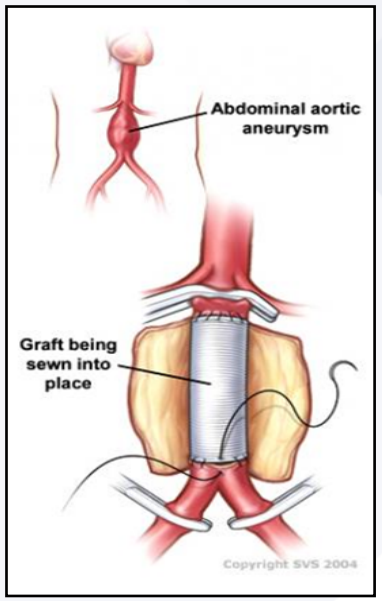
Why are we thinking about AAAs?

- AAAs are dilatations of the abdominal aorta
- Present in ? 5-10% of men aged 65-79 years
- AAAs expand asymptomatically until they rupture-unless individual dies of something else
- AAA rupture carries high mortality:
  - individual may die before they can get emergency repair
  - emergency repair itself carries high mortality



Screening can help

- AAAs can be detected before rupture by abdominal ultrasound scan
- Idea is that individuals with large AAAs (> 5.5 cm) can be offered elective repair (<5% mortality)
- Population-based screening for AAA in older men reduces AAA-related mortality by about 40%
- In the UK, NHS has had a AAA screening program (one-off ultrasound for men aged 65 years) since 2009
- Sweden since 2006
- US: Medicare funds same for men aged 65-75 who have 'ever smoked' since 2007
- NZ: nothing yet



Methods

1. Borrowed Markov model from UK

2. Replaced with NZ inputs as far as possible:

- ❑ NZ life expectancy
- ❑ NZ background morbidity
- ❑ NZ health system costs
- ❑ NZ's own pattern of operative repair and postoperative mortality
- ❑ NZ surveillance regimen for small and medium AAAs
- ❑ Etc.

3. Re-ran the model

Pretty cost-effective

	Incr QALYs	Incr costs	ICER
Non-Māori	0.023 [0.007 to 0.047]	$ 142 [$63 to $267]	$ 6647 [$4262 to $12,176]
Māori	0.014 [0.004 to 0.030]	$ 133 [$60 to $248]	$ 9692 [$5949 to $18,178]
Both	0.022 [0.007 to 0.045]	$ 141 [$62 to $266]	$ 6793 [$4348 to $12,497]

Draft results—may change once model finalised

So what?

Criteria for assessing screening programmes

1. *The condition is a suitable candidate for screening.*
2. *There is a suitable test.*
3. *There is an effective and accessible treatment or intervention for the condition identified through early detection.*
4. *There is high quality evidence, ideally from randomised controlled trials, that a screening programme is effective in reducing mortality or morbidity.*
5. *The potential benefit from the screening programme should outweigh the potential physical and psychological harm (caused by the test, diagnostic procedures and treatment).*
6. *The health care system will be capable of supporting all necessary elements of the screening pathway, including diagnosis, follow-up and programme evaluation.*
7. *There is consideration of social and ethical issues.*
8. *There is consideration of cost-benefit issues.*

BODE^3 Team Members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