Eight Interventions to Reduce Dietary Salt

comparing their health gains, costs, and cost-effectiveness

SUMMARY

High sodium or salt in diets is a critical risk factor for cardiovascular disease. Sodium reduction is considered a public health priority area. We evaluated the impact of eight different interventions to reduce dietary salt on health gains, health system costs, and cost-effectiveness. Some of these interventions are more feasible (having been implemented in the UK and in New Zealand), and some interventions are more theoretical (marked with a * below).

We evaluated eight different interventions to reduce dietary salt

We compared eight different interventions to reduce dietary salt::

- Mandatory 25% reduction in sodium levels in all processed foods
- Mandatory 25% reduction in sodium levels in bread, processed meats, and sauces
- A package of interventions performed in the UK (mass media campaign + voluntary food reformulation + food labelling changes)
- A mass media campaign similar to a previous UK one
- Voluntary endorsement food labelling as currently used in NZ
- Dietary counselling as currently used in NZ
- A "sinking lid" on the amount of food salt released to the national market to achieve the average adult intake of 2300 mg sodium/day*
- A salt tax*

The target population was the entire 2011 NZ population aged 35 years and older (2.3 million people).

We modelled the impact of these interventions on health gains, health system costs, and cost-effectiveness

The model estimated how much health benefit was gained (in quality-adjusted life-years or QALYs) from these dietary salt reduction interventions, and how much it cost or saved the health system. We also investigated how these health and economic impacts differed by age, sex, and ethnicity.

What is the impact of these interventions?

Of the most feasible interventions, the largest health gains were from (in descending order) mandatory 25% reduction in sodium levels in all processed foods, followed by the UK package of interventions, then mandatory 25% reduction in bread/processed meats/sauces, followed by the media campaign, voluntary endorsement food labelling as used in NZ, and dietary counselling as used in NZ. Even larger health gains came from the more theoretical "sinking lid" intervention (211,000 QALYs) and the salt tax. All the interventions produced net cost savings, except for dietary counselling (which was still cost-effective). Cost savings were especially large for the sinking lid intervention (NZ$ 1.1 billion). Health gain per person was greater for Māori men and women compared to non-Māori.

Our bottom line

This evaluation suggests that some of these interventions to reduce dietary salt might achieve major health gains and major cost savings (particularly the regulatory interventions). They could also reduce health inequalities.

For more detail refer to: Nghiem N, Blakely T, Cobiac LJ, Pearson AL, Wilson N. Health and economic impacts of eight different dietary salt reduction interventions. *PLoS One* 2015;10(4):e0123915.

IN MORE DETAIL

Eight Interventions to Reduce Dietary Salt

A diet high in sodium is a major risk factor for non-communicable diseases like cardiovascular disease. Sodium reduction is considered a public health priority globally. We evaluated the impact of eight different interventions to reduce dietary salt on health gains, health system costs, and cost-effectiveness. These were:

- Mandatory 25% reduction in sodium levels in all processed foods [*Mandatory All*].
- Mandatory 25% reduction in sodium levels in three groups of processed foods: bread, processed meats, and sauces [*Mandatory 3G*].
- A package of interventions performed in the UK between 2003-2009 but applied to NZ: a mix of a mass media campaign, voluntary food reformulation and food labelling changes.
- A media campaign similar to a previous UK one (just the mass media campaign component of the UK package above)
- Voluntary endorsement food labelling as currently used in NZ (the "Tick Programme" – an endorsement label programme run by the Heart Foundation).
- Dietary counselling by dietitians to reduce sodium intake, part of current practice in NZ
- A "sinking lid" on the amount of food-grade salt released to the national market, reduced annually to the point where the recommended level of sodium intake is achieved (2300 mg sodium/day)*.
- A salt tax*: an excise tax applied and increased up to the point where the recommended level of sodium intake is achieved (2300 mg/day).

The interventions with the asterisk* are considered more theoretical or hypothetical, whereas the other interventions have to varying extents been implemented in NZ or other countries (e.g., the UK and European countries with regulated maximum levels of sodium in certain foods). All interventions are compared to a theoretical "do nothing" comparator, i.e. doing none of the interventions of interest in the analysis.

Model

We began with the entire 2011 NZ population aged 35 years and older (2.3 million people), and used a Markov macrosimulation model to follow this population through to death or 100 years. Basically for each intervention, a reduction in sodium intake was linked to a reduction in systolic blood pressure, which was then linked to a reduction in the probability of coronary heart disease and stroke events. The model estimated:

- Health gain in quality-adjusted life-years or QALYs.
- Health system costs in NZ$ (including those associated with living longer lives as a result of the intervention).
- Cost-effectiveness in Incremental Cost-Effectiveness Ratios or ICERs (NZ$ per QALY)
- Impact on health inequalities.

QALY or Quality-Adjusted Life-Year:

The remaining life expectancy, adjusted for quality of life. Think of one QALY as one year of life in perfect health.

Assumptions in the Model

Our model contains multiple assumptions. Some of these assumptions apply across all BODE^3 evaluations, and are described in a range of protocols at the BODE^3 website here. Some assumptions are specific to this topic: please refer to the journal article on this study for more information. Some of our key assumptions include the following:

- We used a health system perspective and so did not include costs and consequences beyond the health system (such as benefits to workplace productivity from preventing disease in working age adults).
- We included costs both related and unrelated to the intervention (meaning if the intervention helped individuals live longer, we included the health system costs of their "living longer").
- We allowed for expected or background disease and limited the maximum amount of QALYs that could be gained with increasing age.

ICER or Incremental Cost-Effectiveness Ratio:

The difference in costs between one intervention and its comparator, divided by the difference in health gain. An ICER tells you how much more (or less) cost-effective an intervention is compared to something else.

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- We applied a 3% discount rate to costs and QALYs gained.
- We assumed a continued decline in the incidence of both coronary heart disease and stroke (of 2% annually) and also a reduction in case-fatality from these diseases (of 2% annually), due to improved treatment and management. This projection was extended to the year 2026, and then incidence and case-fatality was held constant after that.

QALYs and Cost Savings/Cost-Effectiveness

QALYs

The largest QALY gains over the lifetime of the population were from the sinking lid in food salt released to the market intervention (211, 000 QALYs gained, ranging from 170,000 to 255,000 QALYs). This was followed by the salt tax (195,000 QALYs), mandatory 25% sodium reduction in all processed foods (110,000 QALYs), the UK package of interventions (85,100 QALYs), mandatory 25% sodium reduction in bread/processed meats/sauces (61,700 QALYs), media campaign as per UK one (25,200 QALYs), voluntary endorsement label programme (7,900 QALYs) and dietary counselling (200 QALYs).

Cost Savings/Cost-Effectiveness

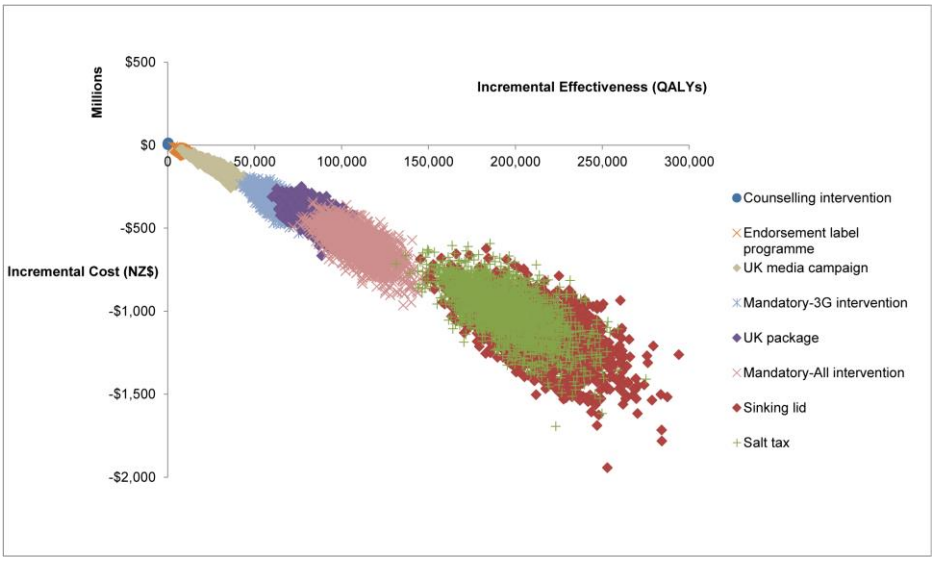
The sinking lid intervention produced the highest net cost savings of NZ $1.1 billion. The salt tax was both cost-saving (NZ$ 1 billion) and would also actually raise NZ$ 452 million in annual revenue by 2021. The only intervention not found to be cost-saving was dietary counselling, although this was still typically cost-effective at NZ$ 36,900 per QALY gained (ranging from NZ$ 22, 400 to NZ$ 62,500).

Cost-Effectiveness Plane

The cost-effectiveness plane below shows the eight salt interventions modelled. The y-axis shows health system costs in NZ$ millions, and note that most interventions sit in "negative cost" i.e. cost-savings. The x-axis shows health gain in QALYs. There is uncertainty in any intervention we model, and the size of the scatter plots reflect the amount of uncertainty (the larger the cloud, the greater the uncertainty).

Cost-effectiveness Threshold or Willingness-To-Pay:

Society's willingness to pay for an extra unit of health gain e.g. a QALY. If the ICER for an intervention is less than the threshold, the government can view it as cost-effective and may fund it. If ICER is greater than the threshold, it is not deemed to be cost-effective and the government may not fund it.



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QALYs and Cost Savings in Different Populations

Age	QALYs gained and cost savings were greater for younger age groups (< 65 years) across all interventions except dietary counselling. Dietary counselling was not cost-effective for older ages (65+ years).
Sex	QALYs gained and cost savings were greater for men compared to women across all interventions except dietary counselling. Dietary counselling was not cost-effective for women.
Ethnicity	QALY gains were higher for Māori than for non-Māori, across all interventions.

Equity Analysis

Māori have higher background disease and death rates compared to non-Māori. Māori can be therefore automatically "disadvantaged" in routine economic evaluations because Māori have a more limited envelope of future QALYs that can be gained from health interventions. We therefore conducted an 'equity analysis' to adjust for this, applying non-Māori rates of background disease and death to Māori instead of using Māori rates. As a result QALY gains for Māori improved even further.

Uncertainty in our Results

There is unavoidable uncertainty present in the values we put into our models, and thus uncertainty in estimates of QALYs and cost savings. An important area of uncertainty is how sensitive the population is to price changes as a result of any salt tax, particularly at higher prices. The BODE^3 team is currently doing more work in this specific area.

Changing Some Assumptions

The results of the evaluation are sensitive to different assumptions. For example:

What if we modelled dietary counselling as a group counselling rather than individual counselling?	Dietary counselling became cost-saving.
What if we assumed lower case fatality for coronary heart disease and stroke?	Dietary counselling remained cost-effective, and all other interventions remained cost-saving.
What if we discounted QALYs and costs at 6% (instead of 3%)?	Dietary counselling became not cost-effective but other interventions remained cost-saving, though less so.

Our Bottom Line

1. This evaluation suggests that some of these interventions to reduce dietary salt might achieve major health gains and major cost savings (particularly the regulatory interventions). They could also reduce health inequalities.
2. A salt tax would have the added benefit of raising revenue (that could then be used for funding the health system or reducing other taxes).
3. There is relatively greater health benefit from mandatory (versus voluntary) interventions, and this is consistent with previous modelling work around salt reduction interventions.

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