Background Report for BODE^3 Modelling on Estimating the Impact of the Tick Programme in New Zealand (a Heart Health Food Endorsement Programme)

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(See acknowledgements for those providing addition input).

Abstract

Background: Many countries have health-related endorsements (as symbols or logos) on packaged foods, including New Zealand with a Pick the Tick Programme. However, the size of the impact of this approach on food composition and nutrient intakes at the population level is largely unquantified. To inform modelling work on the cost-effectiveness of cardiovascular disease prevention, we aimed to estimate the difference in diet between New Zealand with the Tick Programme, compared to the counterfactual of no Tick Programme ever having existed in New Zealand.

Methods: The average New Zealand adult intake of sodium, saturated fat and energy by food category (including separately for Tick Programme and non-programme foods) was estimated by merging 2012 "NutriTrack" data (brand-specific food composition) and national nutrition survey data. We then identified the differences between Tick products and non-Tick products and from this estimated what the New Zealand diet would have been had there been no Tick products.

Results: There were 448 of the 8440 (5.3%) packaged food items in NutriTrack that displayed the Tick. Compared to a counterfactual of no Tick Programme, we estimate that saturated fat was 1.0 g/day less (3.2% of daily intake of saturated fat for the average New Zealand adult), sodium 38.0 mg/d less (1.1%) and dietary energy 72 kJ/d less (0.8%).

Conclusions: These results were generated to facilitate BODE^3 Programme modelling work for sodium and saturated fat reduction. They are subject to many uncertainties which could mean that they either under or over-estimate the impact of the Tick Programme. In particular, the counterfactual of no Tick Programme is simplistic (given that food manufacturers might have produced relatively more Tick-like products if no Tick Programme existed).

Introduction

A number of countries have health-related endorsement programmes for food products to promote health. For example, in Finland a "Heart Symbol" is used[1], in Sweden a "Green Keyhole" logo,[2] in the Netherlands a "Choices" health logo[3] and in Australia and New Zealand a heart-health tick logo.[4] There is some experimental evidence that such endorsement logos have an impact on people making healthier food choices,[5] and there is also evidence that they contribute to healthier food reformulation by the food industry (eg, for reductions in sodium and saturated fat in Netherlands,[6] for sodium in Australia[7] and for sodium in New Zealand[4]). One study has also reported that the Tick Programme in Australia is a relatively cost-effective intervention.[8]

The heart-health Tick logo in New Zealand is promoted by a non-governmental agency: the Heart Foundation. It is identical in appearance to the one used in a similar Australian Programme. Further details of the New Zealand Heart Foundation's Tick Programme are on the Foundation's website,[9] but briefly it is a heart health-related endorsement system that promotes healthier food choices with around 1100 "Tick approved" products that span 61 different food categories. Food companies can pay for the right to use the Tick logo on food products that meet the Tick criteria (with these particularly covering saturated fat and sodium levels). It is primarily a "within-food-category" system in that it promotes healthier choices within a food category (eg, between different margarines or between different milk products).

Previous work has reported a benefit of this particular Tick Programme in terms of reformulation to reduce sodium levels in breads, margarines and cereals.[4] This research found that breakfast cereals in the programme had the largest reduction in sodium content by an average of 378 mg sodium per 100 g product (61%). Sodium in bread was reduced by an average of 123 mg per 100 g product (26%) and margarine by 53 mg per 100 g (11%).

Another study also considered the impact of the very similar Tick Programme in Australia,[7] reporting that for 12 reformulated breakfast cereals, sodium reductions ranged from 85 to 479 mg per 100 g and an average reduction of 40% (12-88%). Of note was that only five of the 12 products were eligible to carry the *Pick the Tick* logo after the reformulation programme, and these products accounted for around half (53%) of the total salt reduction. This result would suggest that Tick Programme participation may lead to wider changes in food composition in addition to just for the foods with the Tick logo. Furthermore, it seems plausible that some of the reported reduction in mean sodium content in bread in New Zealand from 469 mg/100 g in 2007 to 439 mg/100 g in 2010,[10] is due to reformulation efforts associated with the Tick Programme. Nevertheless, other activities such as the Heart Foundation's "Heartsafe" Programme (which involves encouraging food reformulation by the food industry) are likely to have also played a role in such changes (see: http://www.heartfoundation.org.nz/programmes-resources/food-industry-and-hospitality/heartsafe).

Other research has explored awareness of use of various nutrition labels including the Heart Foundation's Tick.[11] This work involved 158 people in focus groups and it found that Māori (indigenous New Zealanders), Pacific peoples in New Zealand, and

low-income citizens were found to rarely use nutrition labels to assist with food purchases (ie, only 10% of this sample). Reasons given for this were: lack of time to read labels, lack of understanding, shopping habits and relative absence of simple nutrition labels on the low-cost foods they purchase. In terms of labelling, the authors of this study recommended consideration of a "mandatory nutrition labelling system that uses simple imagery like traffic lights".

In this document, we aimed to inform modelling work on the cost-effectiveness of cardiovascular disease prevention by estimating the difference in diet between New Zealand with the Tick Programme, compared to the counterfactual of no Tick Programme existing in New Zealand.

Methods

Food availability and nutritional data: We obtained NutriTrack data for 2012 as collected by the National Institute for Health Innovation at the University of Auckland. This is a data source which has been used in previous nutrition studies.[12 13] These data were collected from the packages of all food and beverage products available for sale at two major supermarket chains (one store representing each) in Auckland between February and May 2012. Data were collected for all packaged foods (including different package sizes) displaying a nutrition information panel, with the exception of baby food, alcohol, and sports supplements and foods. The data included which products had the Tick and the sodium, saturated fat and energy content of the products (per 100 g, or per 100 ml for some beverages). We subsequently made some additional refinements to how NutriTrack data were sub-categorised (eg, classifying milk by differing levels of total fat).

Intake of key nutrients for the NZ adult population: We extracted food category specific data on sodium intake, saturated fat intake and dietary energy from national surveys, particularly the 2008/2009 New Zealand Adult Nutrition Survey (NZANS).[14] Total sodium intake based on urinary sodium excretion data also came from the NZANS, but for estimates of proportional food category contributions to dietary sodium intake we had to rely on an earlier national nutrition survey from 1997 (NNS97)[15] and also the NZ Total Diet Survey of 2009 (NZTDS).[16]

The counterfactual and analytic approach: The counterfactual we used was that of a Tick-product free New Zealand where no health sector endorsed Tick (or Tick-like logo) existed (ie, actually probably like most other countries). In this fictional Tick-product free New Zealand, food manufacturers only cater for the "health conscious" segment of the market by labelling their foods as per the current range of non-Tick products (ie, with some of them having "salt reduced" and "lite" on the packaging).

To estimate the difference between the current situation and this counterfactual we compared the products with the Tick to those without the Tick within each food category. As a simple explanation of the approach taken, assume that 50% of the products in a food category (eg, margarines) had the Tick and that in these Ticked products the sodium level was on average 50% that of non-Ticked products. Then the impact of the Tick Programme on the dietary contribution of sodium from the

margarine group (relative to the counterfactual) was calculated to be a 25% reduction (50% x 50%). However, in our actual analysis we also adjusted for numbers of the same products in the NutriTrack dataset and also the product weights since Tick products were often smaller in size than comparable non-Tick products (see the actual formulae below). The limitations of this approach are considered further in the *Discussion Section* of this document.

More specifically, food categories were matched between NutriTrack (Table 1) and NZANS. For most food categories it was possible to make direct matches, but with some exceptions (see footnotes to Table 2). Then for each food category we calculated the average nutrient content (sodium, saturated fat and dietary energy), of the products with the Tick and those without. This estimate was weighted by: (i) the relative number of all the products in each category with and without the Tick (Equation 1); and (ii) the different weights (in grams) of the products (Equation 2). Then based on the estimated nutrient intake for each food category (as per those in Table 2) for a typical New Zealand adult, we estimated the absolute differences for the daily intake of these nutrients (Equation 3).

Formulae for calculating the impact of products with the Tick on different nutrient contributions to the New Zealand adult diet

The package size weighted formula for nutrient contents:

$$\text{Equation 1} \qquad \bar{x}_{T/nT} = \frac{\sum_{i=1}^{n} w_i \times x_i}{\sum_{i=1}^{n} w_i}$$

where: $\bar{x}_{T/nT}$ is the weighted nutrient content for a Tick/non-Tick food group category, n is the number of product items in this food category, x_i is the nutrient content of the product i, and w_i is the package size of the product i.

The weighted formula by the number of product items for nutrient contents:

$$\text{Equation 2} \quad \bar{x} = \frac{b_T \times \bar{x}_T + b_{nT} \times \bar{x}_{nT}}{b_T + b_{nT}}$$

where: $\bar{x}$ is the weighted nutrient content, and $b_{T/nT}$ is the number of Tick/non-Tick product items.

The summed difference between the current intake with the Tick Programme and the counterfactual non-Tick world:

$$\text{Equation 3} \quad dIntake = \sum_{i=1}^{35} \left(\frac{\bar{x}_j}{\bar{x}_{nT,j}} - 1 \right) \times y_j$$

where: $dIntake$ is the summed difference between the current intake with the Tick Programme relative to the counterfactual non-Tick world, and y_j is absolute nutrient contribution of food group j in the total current daily diet.

Additional adjustments to the final results included adjustment to nutrient intakes by taking account of salt added in cooking and at the table, and from sources not covered by the NutriTrack data such as takeaways meals (as detailed in Table 2).

A key assumption made was that NutriTrack data on products available in the supermarkets was approximately representative of the relative sales share of these products. This assumption is probably reasonable given the findings of a study of sodium in foods in the UK, which has a similar food supply to New Zealand.[17] This UK study reported that the difference between the mean level of "sodium in products for sale" and the mean level of sodium in the sales weighted products was modest (356 vs 320 mg/100 g respectively for 2006 data [10% difference] and 330 vs 299 mg/100 g for 2011 data [9% difference]).

Results

Out of the 8440 items in the NutriTrack dataset, 5.3% had the Tick (448/8440), as detailed in Table 1. The major food category with the most Tick products was dairy (n=130; 12% of products in that category), followed by cereals and cereal products (n=120; 14%), and then edible oils (n=53; 33%). The major categories of "snack foods" and "sugar and sweets' had no products with the Tick.

Within minor food categories, the Tick was on 60% of margarines and 0% of butter items. It was on 80% of "very low fat milk" products, 42% of "low fat milk", 54% of "reduced fat milk", and 0% of whole milk (ie, consistent with the health orientation of the Tick endorsement).

Table 1: Food items in the NutriTrack dataset and coverage with the Heart Foundation's Tick logo (a heart health-related endorsement logo)

Food categories (major [bold] and minor)	**No Tick**		**With the Tick**		**Total**
	N	**%**	**N**	**%**	
Beverages	**846**	**99.7%**	**3**	**0.4%**	**849**
Cordial bases – dry	60	100.0%	0	0.0%	60
Cordial bases – liquid	64	100.0%	0	0.0%	64
Energy and electrolyte drinks	80	100.0%	0	0.0%	80
Fruit and vegetable juices	222	98.7%	3	1.3%	225
Hot drink mixes (eg, "Milo")	125	100.0%	0	0.0%	125
Ice tea drinks	21	100.0%	0	0.0%	21
Soft and flavoured drinks	215	100.0%	0	0.0%	215
Soy drinks	24	100.0%	0	0.0%	24
Water	35	100.0%	0	0.0%	35
Bread and bakery products	**964**	**99.6%**	**4**	**0.4%**	**968**
Biscuits and crackers	518	99.6%	2	0.4%	520
Breads	122	100.0%	0	0.0%	122
Breads – other	111	100.0%	0	0.0%	111
Cakes muffins and pastry	178	99.4%	1	0.6%	179
Flat breads	35	97.2%	1	2.8%	36
Cereal and cereal products	**752**	**86.2%**	**120**	**13.8%**	**872**
Bran	8	61.5%	5	38.5%	13
Breakfast cereals	167	73.6%	60	26.4%	227
Cereal bars	120	87.6%	17	12.4%	137
Flour	40	100.0%	0	0.0%	40
Grains	20	95.2%	1	4.8%	21
Noodles	102	100.0%	0	0.0%	102
Pasta – fresh	39	69.6%	17	30.4%	56
Pasta – other	139	90.9%	14	9.2%	153
Rice	78	92.9%	6	7.1%	84
Rice-based dishes	39	100.0%	0	0.0%	39
Convenience foods	**340**	**94.2%**	**21**	**5.8%**	**361**
Pizzas	40	95.2%	2	4.8%	42
Pre-prepared salads and sandwiches	9	100.0%	0	0.0%	9
Ready meals	123	86.6%	19	13.4%	142
Ready snacks	27	100.0%	0	0.0%	27
Soups	141	100.0%	0	0.0%	141

Dairy	**949**	**88.0%**	**130**	**12.1%**	**1079**
Cheeses – hard	334	99.4%	2	0.6%	336
Cheeses – hard	334	99.4%	2	0.6%	336
Cheeses – processed	46	100.0%	0	0.0%	46
Cheeses – soft	57	78.1%	16	21.9%	73
Cream	46	100.0%	0	0.0%	46
Desserts	24	96.0%	1	4.0%	25
Ice cream	177	97.3%	5	2.8%	182
Milk – very low fat (<0.3% fat)	3	20.0%	12	80.0%	15
Milk – low fat (0.3–1.4% fat)	11	57.9%	8	42.1%	19
Milk – reduced fat (1.5–2.9% fat)	29	46.0%	34	54.0%	63
Milk – whole (≥3% fat)	27	100.0%	0	0.0%	27
Milk – other	33	91.7%	3	8.3%	36
Powdered milks – not-trim	10	100.0%	0	0.0%	10
Powdered milk – trim	5	71.4%	2	28.6%	7
Yoghurt	147	77.0%	44	23.0%	191
Edible oils and oil emulsions	**108**	**67.1%**	**53**	**32.9%**	**161**
Butter	15	100.0%	0	0.0%	15
Margarine	23	39.7%	35	60.3%	58
Oils – olive / avocado	36	73.5%	13	26.5%	49
Oils – other vegetable	34	87.2%	5	12.8%	39
Eggs	**38**	**100.0%**	**0**	**0.0%**	**38**
Fish and seafood	**222**	**88.1%**	**30**	**11.9%**	**252**
Canned fish and seafood	119	93.0%	9	7.0%	128
Chilled fish and seafood	34	97.1%	1	2.9%	35
Frozen fish and seafood	69	77.5%	20	22.5%	89
Fruit and vegetables	**781**	**95.8%**	**34**	**4.2%**	**815**
Frozen potato products	58	92.1%	5	7.9%	63
Frozen vegetables	78	85.7%	13	14.3%	91
Fruit in juice/syrup	165	100.0%	0	0.0%	165
Fruit-bars	35	100.0%	0	0.0%	35
Fruit – dried	105	100.0%	0	0.0%	105
Fruit – frozen	17	100.0%	0	0.0%	17
Nut and fruit bars *	26	100.0%	0	0.0%	26
Nuts and fruit *	6	100.0%	0	0.0%	6
Pickled vegetables	107	100.0%	0	0.0%	107
Ready to eat salads	25	100.0%	0	0.0%	25

Vegetables – canned	142	91.6%	13	8.4%	155
Vegetables – dried	17	85.0%	3	15.0%	20
Meat – fresh (with nutrient labels)	**26**	**74.3%**	**9**	**25.7%**	**35**
Nuts and seeds	**170**	**95.5%**	**8**	**4.5%**	**178**
Nuts and seeds	68	100.0%	0	0.0%	68
Nuts – unsalted	67	91.8%	6	8.2%	73
Peanut butter	35	94.6%	2	5.4%	37
Other miscellaneous	**237**	**97.9%**	**5**	**2.1%**	**242**
Processed meat	**511**	**96.8%**	**17**	**3.2%**	**528**
Beef	129	99.2%	1	0.8%	130
Chicken	134	89.3%	16	10.7%	150
Processed meat unclear/mixed	109	100.0%	0	0.0%	109
Pork	139	100.0%	0	0.0%	139
Sauces, spreads and seasonings	**1094**	**98.7%**	**14**	**1.3%**	**1108**
Asian sauces	41	100.0%	0	0.0%	41
Dressings	74	89.2%	9	10.8%	83
Gravy	45	100.0%	0	0.0%	45
Marinades	20	100.0%	0	0.0%	20
Mayonnaise	41	91.1%	4	8.9%	45
Mustard	26	100.0%	0	0.0%	26
Pasta sauce	103	100.0%	0	0.0%	103
Seasonings	69	100.0%	0	0.0%	69
Sauces – dry	87	100.0%	0	0.0%	87
Sauces – other	273	100.0%	0	0.0%	273
Spreads	284	100.0%	0	0.0%	284
Tomato paste	31	96.9%	1	3.1%	32
Snack foods	**752**	**100.0%**	**0**	**0.0%**	**752**
Crisps and snacks	290	100.0%	0	0.0%	290
Sweet snacks	462	100.0%	0	0.0%	462
Sugar and sweets	**202**	**100.0%**	**0**	**0.0%**	**202**
Jams	99	100.0%	0	0.0%	99
Sugar	50	100.0%	0	0.0%	50
Sweet sauces	53	100.0%	0	0.0%	53
Total	**7992**	**94.7%**	**448**	**5.3%**	**8440**

* These nut and fruit mixes were included with fruit and vegetables as the fruit components generally dominate over the nuts.

Table 2 shows the distribution of estimated intakes of the nutrients of interest by major food category and selected minor food categories for adult New Zealanders, and counterfactual estimates of change in nutrient intake for New Zealand with the Tick Programme compared to the counterfactual of no Tick programme.

The major reductions for estimated sodium intake in absolute terms (mg of sodium intake) were from the use of the Tick on margarines, followed by its use on processed chicken products, fish products, and various dairy products. For estimated saturated fat intake, the equivalent most relevant products were: cheese, various other dairy products, and margarine.

Table 2: Current contribution of foods to sodium, saturated fat and energy to total New Zealand diet, and estimated absolute difference for New Zealand with Tick Programme compared to the counterfactual of no Tick Programme

Major food categories [bold] (and selected minor food categories)	**Sodium**			**Saturated fat**			**Dietary energy**		
	Contribution in NZ diet		Difference via Tick*	Contribution in NZ diet		Difference via Tick*	Contribution in NZ diet		Difference via Tick*
	%	mg/day	mg/day	%	g/day	g/day	%	kJ/day	kJ/day
Beverages	1.9[#]	67	-0.21	1.7	0.5	0.01	5.0	446	-0.1
Bread & bakery products	19.4[#]	686	-0.45	2.3	0.7	-0.002	11.0	981	-0.1
Cereal and cereal products	6.7	239	2.04	5.1[#]	1.6	-0.04	14.2[#]	1266	7.2
Convenience foods	4.0	143	-2.76	9.6[#]	3.0	-0.08	5.9[#]	525	-5.9
Eggs	0.8	30	NA	2.2	0.7	NA	1.5	134	NA
Fish and seafood	2.0	71	-3.93	1.8	0.6	-0.01	1.9	166	2.8
Fruit and vegetables	1.1	39	-1.10	1.3	0.4	-0.02	3.1	273	-1.2
Meat – fresh (with nutrient labels)	0.2	8	-0.10	0.7	0.2	-0.04	0.5	44	-3.2
Nuts and seeds	0.5	17	-0.73	1.6	0.5	-0.003	1.2	107	0.2
Other miscellaneous	0.0	0	0.00	3.0	0.9	-0.01	3.9	352	-5.0
Sauces spreads and seasonings	5.9	210	-0.98	1.4	0.4	-0.004	1.4	125	-0.6
Snack foods	0.9	33	NA	0.8	0.2	NA	1.3	116	NA
Sugar and sweets	0.0	0	NA	2.8	0.9	NA	4.2	374	NA
Dairy[##]									
Milk – very low fat (<0.3% fat)	0.1	4	-0.57	0.1	0.0	0.002	0.03	3	-0.1
Milk – low fat (0.3–1.4%)	0.1	5	0.76	0.4	0.1	0.04	0.2	22	3.2
Milk – reduced fat (1.5–2.9%)	0.4	15	-2.03	2.0	0.6	0.14	1.3	116	-7.7
Milk-whole (≥3%)	0.2	7	NA	2.4	0.7	NA	1.6	140	NA
Powdered milks	0.1	2	NA	2.8	0.9	NA	1.8	162	NA
Powdered milk – trim	0.1	2	-0.42	0.1	0.0	-0.003	0.04	4	-0.9
Cheeses	2.6	93	0.10	6.3	2.0	-0.47	1.9	169	-16.7
All other dairy products	3.1	109	-3.69	4.7	1.5	-0.29	2.5	223	-34.1

Major food categories [bold] (and selected minor food categories)	Sodium			Saturated fat			Dietary energy		
	Contribution in NZ diet		Difference via Tick*	Contribution in NZ diet		Difference via Tick*	Contribution in NZ diet		Difference via Tick*
	%	mg/day	mg/day	%	g/day	g/day	%	kJ/day	kJ/day
Edible oils and oil emulsions[##]									
Butters	0.7	26	NA	1.7	0.5	NA	0.6	55	NA
Margarines	2.8	101	-19.43	6.8	2.1	-0.19	2.4	212	-9.8
Oils – olive / avocado	0.0	0	0.00	0.2	0.1	0.0002	0.2	15	0.01
Oils – vegetable	0.0	0	0.00	0.2	0.1	-0.003	0.1	12	-0.1
Processed meat[##]									
Beef	2.4	84	-0.23	1.1	0.3	-0.002	0.6	50	-0.1
Chicken	2.8	97	-4.27	1.3	0.4	-0.02	0.7	58	0.0
Processed meat unclear/mixed	2.0	71	NA	0.9	0.3	NA	0.5	42	NA
Pork	2.5	90	NA	1.2	0.4	NA	0.6	54	NA
Other adjustments									
Unpackaged fish and seafood (no nutrient labels)**	1.0	36	NA	0.9	0.3	NA	0.9	83	NA
Unpackaged fruit and vegetables**	2.2	78	NA	2.5	0.8	NA	6.1	547	NA
Unpackaged fresh meat**	4.5	158	NA	14.1	4.4	NA	9.4	838	NA
Takeaway & restaurant food	13.9[#]	494	NA	16.2	5.1	NA	8.5[#]	760	NA
Salt added in cooking and table ###	15.0	532	NA	NA	NA	NA	NA	NA	NA
Alcohol	0.0	0.0	NA	0.1	0.0	NA	4.9	437	NA
Total	**100.0**	**3544**	**-38.0**	**100.0**	**31.2**	**-1.00**	**100.0**	**8910**	**-72.0**
% of daily intake ####			**-1.07**			**-3.21**			**-0.81**

Notes:
T – Tick products
NT – non-Tick products

* Estimated absolute difference in sodium (mg/day) due to the Tick Programme compared to the counterfactual of no Tick Programme based on the difference in nutrient (eg, sodium) density between products (adjusted for frequency of products with and without the Tick in the NutriTrack dataset and the product net weights, while also considering the estimated contribution of that category to total daily intake of that nutrient). Analysis was always based on the nutrient content as purchased – since it is usually only water added to turn say a powdered soup into a soup ready for consumption. There are however, modest changes in some nutrient levels with different types of cooking (including draining off liquid that can contain salt).

** These additional categories were necessary since they lack nutrient labelling and so are not included in the NutriTrack dataset (see Table 1). We estimated that nutrition labelling was absent for: 95% of fresh meat sold in NZ stores, with this being a third for fish/seafood, and two thirds of fruit and vegetables.

All contributions of these nutrients to the dietary intake of the average adult New Zealander were based on values in the NNS97 (for sodium only), and NZANS (for the other nutrients), albeit after slight adjustments after considering selected contributions from the NZTDS for which we considered more useful classifications were available eg, for takeaways (all marked #). For a few categories the process was fairly simplistic eg, for saturated fat contribution from takeaways we used that from “bread based dishes”, “potatoes and kumara” and “pies and pasties” (as used in the NZANS). Also the estimated energy intake from takeaways was based on frequency of takeaway meals as reported in the NZANS

with various assumptions made (eg, that each such meal was equivalent to half the daily intake of energy in kJ).

Within major food categories (eg, dairy products) contributions for various nutrients were adjusted by the item frequency within NutriTrack and average levels of nutrients eg, saturated fat levels for the different types of milk.

In keeping with the approach taken by the NZ Burden of Disease Study, we used a 15% figure (no detailed estimates have been made for the New Zealand setting). Nevertheless, this is not too different from the 11% found in a USA study,[18] and a UK study.[19] Another UK study reports 12%,[20] a Danish study 12%,[21] and in other UK work 10%.[22]

The totals used in the denominator from the NZANS were: sodium intake 3544/d [23]; saturated fat 31.2/d (average of 36.5 g for males and 25.8 g for females), and dietary energy 8914/d (average of 10,380 kJ for males and 7448 kJ for females).

Cost of the Tick Programme: We averaged the last two years of Tick Programme costings from the Heart Foundation, giving a running cost of $621,000 for the calendar year of 2011 – the baseline year used in BODE3 modelling (Table 3). Other notable features of the Tick Programme in the annual reports were also collated (Table 3).

Table 3: Potential data for estimating the cost of running the Tick Programme as reported by the Heart Foundation (as itemised in Annual Reports)

Financial year*	Expen-diture	Comment from annual reports** and other sources
2011/2012	$594,000	For our base year for modelling purposes (calendar year 2011), we averaged these two amounts ie, $621,000.
2010/2011	$648,000	
2009/2010	$677,000	
2008/2009	$856,000	"Consumer research commissioned in February 2009, showed eight out of ten grocery shoppers used the Tick and 61 percent buy Tick products over non-Tick products".
2007/2008	$886,000	"Research undertaken in February 2008 showed 84 percent of grocery shoppers regularly buy healthy food and people who look for healthier food choices are more likely to buy foods with the Tick. Knowledge of the Tick is high, with 98 percent of shoppers aware of it, while 66 percent of shoppers surveyed suggested they would buy a Tick product over a similar product."
2006/2007	$870,000	"49 tonnes (that's 49,000kg) of saturated fat from two of New Zealand's most popular children's dairy food brands. A massive 33 tonnes of salt from breads, margarines and breakfast cereals (that's enough to fill 7,018 skip bins) in one year." "As well, the Tick is leading the way worldwide, giving New Zealanders access to 25 Tick-approved margarines and spreads containing a maximum of just 1% of total fat as trans fat – half the maximum level allowed by Denmark, the first country to take a hard line on trans fat. With 950 Tick-approved products across 53 different food categories, the Tick is a handy tool when it comes to making healthier food choices for you and your family. Including everyday foods as well as foods that should be limited in your diet, the Tick is a guide to a healthier choice in each food category."
2005/2006	$554,000	"The repatriation of the Heart Foundation Tick Programme from Australia, where it has been successfully managed by the National Heart Foundation of Australia, represents another significant milestone

Financial year*	Expen-diture	Comment from annual reports** and other sources
		this year." … "There are around 950 products with the Tick, across more than 50 food categories and covering over 60 food manufacturers." Of note is that for this year it was reported that "Consumer research conducted by the NHF in 2005 found that 73% of main grocery buyers claim to use the Tick 'regularly' or 'sometimes'."[11]

*Financial year ending 30 June.
** For example reference: [24]

Discussion

Why these results might be over-estimates

This analysis has benefited from the availability of brand-specific supermarket product and food composition data (NutriTrack dataset), which represents where most New Zealanders buy their food. New Zealand also has the benefit of national nutrition survey data for estimating average adult diets. Nevertheless, the following are reasons why the results obtained might be over-estimates:

Limitations with the counterfactual: We assumed that if there was no Tick Programme, that that the current (processed) food market would be as it is currently for non-Tick products. However, in the absence of the Tick Programme there could still have been more labelling for "reduced salt" and "reduced fat" foods (and some associated reformulation) by food companies. Nevertheless, it is possible that such labelling could have only involved quite modest reductions – relative to current Tick products. Then again, some of the current range of Tick products might have had only no or minimal reformulation. That is they may have already been in a food companies product range when they were submitted for obtaining the Tick certification.

Our analysis was often highly stratified in that we compared a very low fat milk with the Tick to a very low fat milk without the Tick (and similarly within the other three types of fresh milk by fat level). But in other cases we just compared all margarines with the Tick with those without the Tick. Yet in the latter it could be that the more appropriate comparisons are with say the top quartile of "healthiest" margarines and the margarines with the Tick. Such an analysis would have produced lower estimates of benefit from the Tick Programme.

Non-supermarket products: We did not have data on non-supermarket sources of food products eg, smaller superettes and dairies and other outlets (eg, petrol stations). It is possible that such outlets have relatively lower proportions of products with the Tick than large supermarkets.

Compensatory consumer behaviour: We have little information on how Tick foods are actually consumed. For example, it is possible that some people who are habituated to a high salt and saturated fat intake might partially compensate by adding

additional salt or sauces to Tick foods (in cooking or at the table), if they do not taste salty or fatty enough. One experiment indicates that with a salt-reduced soup (both with and without the Tick) subjects tended to add salt.[25] Indeed, some respondents actually over-compensated with this salt addition relative to the sodium in the baseline soup. On the other hand, there is some evidence that once people are on lower salt diets they seem to actually prefer them, according to work that that has measured the hedonic value of dietary salt.[26]

Why these results might be under-estimates

Limitations with the counterfactual: To estimate the differences between the current present of the Tick Programme and the non-Tick counterfactual we did within-category comparisons (ie, we compared a very low fat milk with the Tick with other very low fat milks without the Tick). But as no whole milk products had the Tick we did not capture any potential benefits of people replacing whole milk with any types of lower fat milk.

Our analysis also ignored potential wider pro-health product changes that food companies might do to achieve Tick certification. That is they may reformulate within a whole product range – while only actually getting the Tick logo certified for some of these products. This pattern has been described previously for Australia as per the *Introduction*.[7]

Furthermore, it is possible that manufacturers who do not produce any Tick products may change the composition of some of their products to better compete with the Tick products of their competitors. Indeed, some non-Tick products in New Zealand supermarkets have such labels as "reduced salt" – though the actual nutrient reformulation levels might be fairly minimal.

Legacy effects: Our analysis only considered currently Ticked products. That is, it did not consider legacy benefits from the historical impact of the Tick Programme on sodium levels in bread in the past decade or longer. That is breads previously commonly had the Tick in New Zealand, but this is now rare (see "bread and bakery products" – see Table 1).

Other limitations

Limitations with using NutriTrack data: Although we used a number of different items available for sale and adjusted for item size in our estimations, we still did not have the benefit of sales-volumes. While we suspect that the number of different types of products sold is a reasonable proxy for relative sales (given UK data discussed in the *Methods Section*,[17]) it would be desirable to repeat this analysis with sales-weighted data.

The NutriTrack data also only includes foods that are packaged and have nutrition information panels. This means that our sample of 448 products with the Tick, generally did not include fresh meats, fresh fish and fresh fruit and vegetables – some of which also have the Tick. But our lack of inclusion of all such items in the analysis

would have very little impact on the results given that these fresh products generally all have low sodium and saturated fat levels and cannot generally be "reformulated" to have even lower levels. An exception is cuts of fresh meat that may vary in visible fat content but in fact trimmed fresh meats are not subject to the Tick.

Nutrition survey data: As detailed in the footnotes of Table 2, various assumptions had to be made eg, in adapting nutrition survey data to the categories used in the NutriTrack dataset and accounting for foods not in this dataset. The lack of food category divisions for sodium from the NZANS meant that we had to partly rely on older data from the NNS97 (albeit with some updating from the more recent NZTDS). Nevertheless, the NZANS results for total sodium intake[23] suggests little change overall in population level sodium intakes for New Zealanders in recent decades. But within some food categories changes will have occurred eg, some reduction of sodium in breads[10] and there has been increased access in New Zealand to processed foods produced internationally (with the growth of trade in processed foods). Furthermore, recent work has highlighted a problem with nutrition survey respondents in New Zealand under-reporting their dietary intakes for energy.[27]

Other characteristics of Tick foods: Our analysis did not consider various other aspects of Tick foods. For example Tick foods tend to have higher fibre levels – so that they may provide more satiety – meaning that people might eat less of them and/or eat less of other non-Tick food as well. Also, if foods with the Tick are regarded as more "valuable" than non-Tick foods (especially the ones that cost more), then food wastage of these foods might be relatively less. But if they are considered less palatable, then wastage might be higher. Research in the UK [28], has repeatedly shown that food wastage can be very high for some types of food, but this issue has not been studied in New Zealand.

Limited information on who consumes Tick products?: It seems likely that virtually all New Zealanders derive some benefit from the Tick Programme since they will sometimes eat food prepared by other people who have used Tick products. This will also be the case for shops selling pre-prepared food with the Tick eg, margarine in sandwiches. Also reformulation efforts by manufacturers will probably be having spill-over benefits to other products that never get submitted for getting the Tick (see above).

Heart Foundation consumer survey data for 2013,[29] provides more specific information in that an estimated 87% of "main grocery shoppers" have bought food with the Tick at some time. Also a majority (78%) of such shoppers say that they would "probably" or "definitely" buy a food product with the Tick over a similar product without the Tick. But this research also suggested differences with women having higher level of prompted awareness of the Tick than men (90% vs 77%), and those 55 years of age or over being more likely to definitely/ probably buy a product with the Tick (at 87%).

Australian survey data indicate that the Australian Tick logo is fairly commonly used for purchasing decisions by adults: 19% regularly, 21% often, 35% occasionally, and 24% never [30]. This study found that men who frequently used the Tick were significantly less likely to have a tertiary education and also be more likely to be diagnosed with hypertension. Women who frequently used the Tick were significantly

more likely to be over the age of 45 years, live in a rural area, and be diagnosed with hypertension. It is plausible that such patterns may also apply in New Zealand, though we also suspect that the price differences (slightly higher prices for some products with the Tick), may mean lower use of some Tick products by low-income populations. Nevertheless, to better understand how the use of Tick products is potentially impacting on health – more information around who consumes Tick products is desirable.

Use of these results for modelling

Despite the limitations with the estimates we will use these for BODE^3 modelling on the cost-effectiveness of cardiovascular interventions. Given the uncertainties we didn't formally estimate statistical uncertainty within each food category comparison. Instead, we just applied an arbitrary level of uncertainty of a standard deviation of 20% of the point estimate. That is -22.8 to -53.2 mg/d for sodium and -0.6 to -1.4 g/d for saturated fat.

Comments on possible future developments

This work has produced results that need to be interpreted cautiously, given the limitations outlined above. But the results obtained, along with previous evidence for such endorsement logos systems (see *Introduction*) suggests that the Tick Programme in New Zealand is making a contribution in public health terms. Nevertheless, it is plausible that superior food labelling systems exist, such as traffic light labelling (as per a recent experimental study[5] and various reviews[31 32] albeit with concerns about the quality of the studies[33]). In New Zealand also there is some evidence that simple traffic lights and multiple traffic light labels are best understood across all ethnic and income groups, with the latter being most frequently preferred.[34] There is also the "star rating" system being introduced in Australia on a voluntary basis[35] and which may also be introduced in New Zealand.

Such enhanced labelling systems could be especially effective, particularly if they were made a legislative requirement on all packaged foods. But until they are, continuation with the Tick Programme appears to be highly desirable. Indeed, refinements with the Tick Programme are actually on-going (eg, including lower sugar levels as a criterion for getting the Tick). Expansion of the physical size of the Tick label on the packaging might be another option worth considering. The Tick could also be linked to food sustainability issues. That is, it could be restricted to those foods that meet health criteria but also sustainability criteria (eg, below a certain threshold of greenhouse gas emissions associated with food production, as detailed previously in the New Zealand context[36]).

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