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An Economic Evaluation of Salt Reduction Policies to Reduce Coronary Heart Disease in England: A Policy Modeling Study

Marissa Collins, Helen Mason, Martin O'Flaherty, Maria Guzman-Castillo, Julia Critchley, Simon Capewell

Abstract

Objectives

Dietary salt intake has been causally linked to high blood pressure and increased risk of cardiovascular events. Cardiovascular disease causes approximately 35% of total UK deaths, at an estimated annual cost of £30 billion. WHO and NICE have recommended dietary salt reductions. This study evaluated the cost-effectiveness of four population health policies to reduce dietary salt intake on an English population to prevent coronary heart disease (CHD).

Methods

The validated IMPACT CHD model was used to quantify and compare four policies:

1) Change4Life health promotion campaign, 2) Front-of-pack traffic light labelling to display salt content, 3) Food Standards Agency working with the food industry to reduce salt (voluntary) 4) Mandatory reformulation to reduce salt in processed foods.

The effectiveness of these policies in reducing salt intake, and hence blood pressure, was determined by systematic literature review. The model calculated the reduction in mortality associated with each policy, quantified as life years gained over 10 years.

Policy costs were calculated using evidence from published sources. Health care costs for specific CHD patient groups were estimated. Costs were compared against a "do nothing" baseline.

Results

All policies resulted in a life year gain over the baseline. Change4life and labelling each gained approximately 1960 life years, voluntary reformulation 14,560 life years and mandatory reformulation 19,320 life years.

Each policy appeared cost saving with mandatory reformulation offering the largest cost saving, over £660 million.

Conclusions

All policies to reduce dietary salt intake could gain life years and reduce health care expenditure on coronary heart disease.

Background

Cardiovascular disease (CVD) continues to be a major cause of mortality and morbidity in the UK. The main forms of CVD are coronary heart disease (CHD) and stroke. Approximately 35% of total UK deaths are attributable to CVD, at an estimated annual cost of £30 billion to the UK economy (1) with £14.4 billion being spent on treatments (2). High levels of dietary salt intake promote high blood pressure which is a leading cause of CHD (3). Attention is therefore turning towards developing CVD prevention policies, including substantially reducing dietary salt intake (4). In the UK, the average daily salt intake has subsequently fallen from 9.5g per day in 2000/1 to 8.1g per day in 2011 (5). However this remains well above the 6g per day maximum recommended by the Scientific Advisory Committee on Nutrition (SACN) (6). There is therefore considerable scope to develop policies which focus on further reducing salt intake within the population.

A review of the existing literature on the cost-effectiveness of population health interventions to reduce dietary salt intake found that the majority of papers used modelling techniques to analyse the effects of population health interventions. However, one paper has summarised data from two studies which were implemented in two different community settings; North Karelia, Finland and the Stanford 5 City Project, America. These interventions included health education, screening, and a hypertension control and treatment programme in these community settings (7). The North Karelia study saw a 73% drop in CHD mortality in the region and also a drop in the rest of Finland over the 25 year follow up period. In the Stanford 5 City Project, there were also useful reductions in cholesterol, blood pressure and smoking rates compared to sites which did not have the intervention.

The studies which have used modelling techniques have suggested that legislation for reducing salt intake appears more effective than voluntary agreements (8). In America, government collaboration with the food industry was modelled assuming a decrease in sodium intake of 9.5%. It was estimated that over two million QALYs and over $32 billion in medical costs could be saved (9). Another US study quantified the benefits of a population-wide reduction in salt of up to 3g per day, and estimated annual savings of $10 billion to $24 billion and 44,000 fewer deaths (10). A recent UK analysis estimated that reducing daily salt intake by 3g might result in substantial savings in QALYs and health care expenditure (11). However, this study did not consider exactly how such salt reductions might actually be achieved. In contrast, a recent study conducted in four Eastern Mediterranean countries explicitly compared three policies to reduce salt intake: a health promotion campaign, labelling of food packaging and mandatory reduction of salt content in processed foods. The majority of these policies appeared cost saving compared with the baseline of doing nothing (12).

In order to implement more effective policies in future, UK policy makers will need robust and convincing evidence to assess the costs and benefits of specific interventions. The objective of this paper is to analyse the potential impact on health outcomes of reducing dietary salt intake in an English population. We use an existing model to quantify and compare four population interventions: a health promotion campaign, labelling of foods and both voluntary and mandatory reformulation.

Methods

Salt reduction policies for evaluation

There are currently policies being implemented in the UK which raise awareness of the benefits of reducing salt intake and also encourage people to change their dietary habits. These policies include a health promotion campaign called Change4Life which was launched in 2009 as the social marketing part of the Healthy Weight, Healthy Lives strategy for England (13). This campaign used a range of media, including TV and radio adverts and print media, to encourage people to get active and to promote healthier food choices with a focus on increasing fruit and vegetable consumption and reducing consumption of foods high in fat, sugar and salt. In addition, food labelling is now a requirement in the UK to inform consumers about the nutritional content of the food they buy (14). UK Food manufacturers and retailers are increasingly using the Traffic Light System (TLS) on food packaging where red, amber and green colour codes are used to indicate the levels of fats, sugars and salt (15). However, a potentially confusing variety of schemes currently exist and a standardised approach across all food manufacturers has not yet been implemented. This is highlighted by the recent Department of Health (DH) recommendations on the use of a single “traffic light” nutritional labelling system (16).

In the UK, 75% of the salt eaten comes from processed foods (17). This led to the Food Standards Agency (FSA) launching a health promotion campaign in 2003 alongside working with the food industry to encourage reformulation of processed foods on a voluntary basis. The first salt targets were set in 2006, and subsequently replaced with new targets to be met by 2012. These policies outlined above are currently being implemented in the UK. However, there is little evidence on the relative cost-effectiveness of specific policies.

Such evidence is crucial to direct future policy on salt reduction to reach the recommended daily maximum of 6g per day (6).

We have chosen to evaluate these policies, three of which have already been shown to be feasible in the UK. These are: 1) the Change4Life health promotion campaign which encourages people to eat less and get active, 2) front of pack labelling to display salt content of food using a standardised traffic light system to help consumers to make more informed purchasing decisions, 3) the Food Standards Agency continuing to work with the food industry to reformulate products on a voluntary basis, and 4) mandatory reformulation of processed foods with legislation in place.

Effectiveness of salt reduction policies

The effectiveness of these policies can be expressed as the percentage decrease in dietary salt intake achievable from each policy. Limited information on the effectiveness of voluntary reformulation was already available from successive National Diet and Nutrition Surveys (NDNS) (5). These surveys are used as a way of monitoring the on-going effect of the FSA's work in reducing salt in processed food. Therefore, an assumption has been made that these surveys were capturing the reduction of salt intake from the FSA's work with industry on a voluntary basis. A further assumption was made that voluntary measures alone would not achieve 100% compliance across industry, whereas a mandatory approach might be expected to be more effective, reducing consumption by at least 20%. For the other policies, information on the effectiveness was obtained from published studies. The literature review focussed on the cost-effectiveness of population health interventions and papers which reported estimates of the effectiveness of each policy. Databases searched include MEDLINE, Jstor, Cochrane, and the NHS Economic Evaluation Database (see Appendix 1 for the search strategies).

For each policy, a 'best' estimate was selected from the systematic review. The final effectiveness estimates used in the analysis are presented in Table 1. The best estimates for options 1, 2, 3 and 4 were assumed to be 2%, 2%, 15% and 20% respectively. To account for uncertainty around each best estimate, a minimum and maximum value was also included to provide a range of potential effect sizes for each policy (Table 1).

Table 1: Effectiveness of policies to reduce dietary salt intake

Policy	Details of intervention	Best estimate [min, max]	Study References
Health promotion campaign - Change4life	Advertising (media) campaign promoting healthy eating and physical activity.	2% [1%, 5%]	(17-19)
Labelling	All food packaging would be required to carry labelling to show the salt content as well as other nutritional values using a uniform traffic light labelling system. Monitoring of labels would be required.	2% [1%, 5%]	(17)
Reformulation - voluntary	Salt targets set by the FSA for the reformulation of food products by manufacturers to reach by 2012. These targets are set for food product categories, with sub-categories where relevant. Monitoring of this policy is in progress using urinary analysis and monitoring of food labels.	15% [5%, 20%]	(4,20)
Reformulation - mandatory	Introducing a legislation to impose salt reduction targets on food manufacturers. Monitoring of salt intake levels through urinary analysis and monitoring of food labels would be required.	20% [10%, 32%]	(20)

Health outcomes

We extended the current IMPACT CHD model calibrated for the English population to estimate the effect of different salt reduction policies on mortality and on life-years (18).

Data sources for the IMPACT CHD Model

Mortality and demographic data were obtained from the Office for National Statistics. Patient numbers were estimated for seven mutually exclusive patients groups: Acute Myocardial Infarction (AMI) admissions, unstable angina admissions, secondary prevention post AMI, secondary prevention post revascularisation, angina in the community, heart failure admissions (hospital), and heart failure (community), with data from Hospital Episode Statistics (HES), the Myocardial Ischemia National Audit Project (MINAP) (19) and the General Practice Research Database (GPRD). Systolic blood pressure levels were obtained from the Health Survey for England (HSE) (20). Further details on data sources can be obtained from Bajekal et al (21) and Appendix 2.

IMPACT CHD Model methods

The expected change in salt intake (as presented in Table 1) was translated into a change in blood pressure based on a large meta-analysis, taking into account the differential effect on systolic blood pressure (SBP) of salt intake reduction among hypertensive and non-hypertensive persons(3). The non-hypertensive persons were split into the seven mutually exclusive patient groups outlined above.

The expected number of deaths in 2020 was calculated by estimating 2020 rates using an exponential decay regression model fitted to past mortality rates observed from 1993 to 2010. This model captures how CHD mortality rates decrease over time while avoiding unrealistic negative values. In the regression approach used for SBP, the expected number of deaths from CHD occurring in 2020 was multiplied by the absolute change in risk factor prevalence, and by a regression coefficient quantifying the change in CHD mortality that would result from the change in SBP levels. Natural logarithms were used, as is conventional, in order to best describe the log-linear relationship between changes in risk factor levels and mortality.

In another meta-analysis (22), it was reported that there is an estimated age- and sex-specific reduction in vascular mortality of 50% for every 20 mmHg reduction in SBP, which generated a logarithmic coefficient. This coefficient was then used along with the change in SBP, and the expected number of deaths in 2020 to calculate the number of deaths prevented or postponed (DPPs) for men and women in each age group (22). Further explanation of the DPP calculation is outlined in Appendix 3.

We then estimated the number of life-years gained (LYG), by multiplying the policy's estimated DPPs by the age specific median survival for the different population subgroups (Diagnosed CHD, undiagnosed CHD and population free of CHD). Estimates of median survival were obtained from a previous analysis performed for England and Wales population for 2000 (18,23-25).

Costs

Salt reduction policies

The costs to the public sector of introducing each policy and the costs to the private sector of labelling and reformulating products were included. The cost of each policy was assessed using published evidence where available and the cost of each policy over 10 years was then calculated. The discounted costs are shown in Table 2 and the total costs are shown in Appendix 4.

The costs for the Change4Life health promotion media campaign were obtained from the Department of Health (Freedom of Information request to Department of Health, 2012). The total cost for the campaign for each year since 2009 until 2012 included advertising (television commercials, newspaper advertising and posters), digital and print media, communications planning, public relations, and regional events. The budget did not include staff costs. These costs were assumed to continue every year in the same pattern. A box of all the assumptions used in the analysis is presented in Appendix 5.

The labelling of foods varies due to a variety of factors including the size of the business in question and the type of label used on the packaging in terms of material and colours used. The average cost of labelling per Stock Keeping Unit (a food product with its own unique bar code) was taken from the FSA Impact Assessment 2009 and was estimated at £1,000. This figure was then used with the estimated 20,000 reformulated product lines that will require a change of label to a uniform traffic light system to calculate an overall cost for labelling.

The FSA's Impact Assessment 2009 for the voluntary reformulation strategy includes a figure of £25,000 for the reformulation of one product as supplied by the British Retail Consortium. However, the FSA state that due to the voluntary nature of the strategy it is not appropriate to estimate a total cost for manufacturers as many products are reformulated within a natural product cycle, therefore, the cost for voluntary reformulation includes only the monitoring costs. Although this view was taken, the FSA attempted to estimate the cost of reformulation for industry by using information from the larger UK retailers and other stakeholders to provide a best estimate of the number of lines reformulated within the processed foods categories. This was estimated at 20,000 product lines.

Imposing legislation on food manufacturers to reduce salt levels in processed foods would result in a requirement for manufacturers to reformulate many products outside of natural product cycles and thus could potentially result in additional costs to manufacturers. It is difficult to estimate the exact cost of reformulation for manufacturers, therefore, in order to provide a balanced idea of the costs of legislation we have used a best case and worst case cost for this policy. The best case cost assumes that there are no costs incurred to the industry and therefore is the same as the cost for voluntary reformulation. The worst case cost is calculated using the estimated 20,000 product lines reformulated under the voluntary strategy and the British Retail Consortiums own estimate of £25,000 for the reformulation of one product line. We have not explicitly considered the cost of implementing the legislation in terms of the legal processes involved, and so it is likely that there may be additional costs for reformulation, mainly during year one.

The FSA regularly monitors the effect of these policies on salt intake, to ensure that manufacturers are labelling products correctly and to monitor the current salt content of reformulated foods and the salt levels of the general population. The cost of monitoring for each of these policies has been estimated at £2,384,615 reflecting the rolling cost for the urine analysis conducted by NDNS for the FSA and monitoring of nutrition labels for salt content every two years (26).

This cost is assumed to occur every year since the work is ongoing. There was no monitoring cost associated with the health promotion campaign (Table 2).

Table 2: 10 year discounted policy and monitoring costs

Policy	Policy costs	Monitoring costs	Total cost
Baseline	£0	£0	£0
Change4Life	£41,605,237	£0	£41,605,237
Labelling	£19,323,671	£17,527,929	£36,851,600
Reformulation - voluntary	£0	£17,527,929	£17,527,929
Reformulation - mandatory best case	£0	£17,527,929	£17,527,929
Reformulation - mandatory worst case	£483,091,787	£17,527,929	£500,619,716

Health care costs

The seven mutually exclusive patient groups outlined above were identified using the IMPACT CHD model categories. These events were broken down into treatments, medications and medical professional time or visits. Costs were assigned to each treatment using data from the Department of Health reference costs 2010/11 and The Unit Costs of Health and Social Care 2011 (27). Observed treatment uptake rates were then used to calculate the unit cost for each patient group and then summed to calculate the overall health care costs, shown in table 3.

Table 3: 10 year discounted health care costs for each policy

Policy	Health care costs
Baseline	£15,008,250,131
Change4Life	£14,574,001,919
Labelling	£14,574,001,919
Reformulation - voluntary	£14,406,406,793
Reformulation - mandatory best case	£14,321,677,353
Reformulation - mandatory worst case	£14,321,677,353

Table 3 shows that each policy results in lower health care costs due to the reduction in CHD events from the reduction in dietary salt intake among the population. It shows that the baseline costs are the most costly, with the health care costs from mandatory reformulation being the least.

Analysis

Cost-effectiveness analysis

A ten-year time horizon was taken from 2010 (the model baseline year) to 2020. Policy and health care costs were discounted at 3.5% (28). The total cost of each policy was calculated as the sum of the cost of introducing the policy and the total health care costs over the 10 years. For Change4Life, it was assumed that the campaign would as previously be repeated each year thus the policy costs were assumed to be repeated yearly over the 10 years. For the labelling and reformulation policies, it was assumed that there would be an initial set up cost in the first year and that in the subsequent years would be a monitoring cost to ensure that standards are maintained. Each policy was compared against a baseline of 'do nothing', where no new policy was in place. For the baseline, the current number of CHD patients was extracted from the IMPACT model. The patient numbers after the policies have been implemented were calculated in the model and these numbers were assumed to remain at the new level each year for the remainder of the 10 year period. The number of patients receiving treatments for hypertension does not change with each policy therefore the patient numbers remain the same throughout; this is based on previous observations of trends in hypertension prevalence.

Uncertainty Analysis

Probabilistic sensitivity analysis was used for parameter uncertainty. This was explored using Monte Carlo simulation and involves repeatedly sampling random values from specified statistical distributions for the input variables, and then these values are used to recalculate the model. We used the EXCEL add-in Ersatz software to perform 1,000 runs to determine the 95% uncertainty intervals of the DPPs (2.5th and 97.5th percentile values corresponding to the lower and upper limits); more information is available in Appendix 3. We plotted the estimated distribution of incremental LYG and incremental cost in the cost effectiveness plane, figure 1 below.

Sensitivity Analysis

The minimum and maximum effectiveness estimates in Table 1 were used in the model to provide the range of possible outcomes from each policy including a minimum and maximum LYG and minimum and maximum incremental costs.

Results

The effectiveness estimates for each policy, shown in Table 1, use a percentage reduction in dietary salt intake from the baseline UK salt intake of 8.1g per day. The estimated policy effects on salt intake levels are shown in Table 4.

Table 4: Estimated policy effects on decreases in salt intakes using best estimates (grams per day)

Policy	Estimated reduction by policy	Estimated decrease in salt intake (g/day)		
		Best	Min	Max
Change4life	2%	0.16	0.065	0.486
Labelling	2%	0.16	0.065	0.486
Reformulation-voluntary	15%	1.21	0.324	1.944
Reformulation-mandatory	20%	1.62	0.648	3.110

Table 4 shows that the best estimate of a 2% dietary salt reduction is equal to a reduction of approximately 0.16 grams per day. This equates to an intake of 7.94 grams per day compared with the baseline of 8.1 grams per day in 2011.

Table 5 shows the total discounted cost over 10 years of each policy which includes the policy costs and the associated monitoring costs from table 2 and the health care costs from table 3.

Table 5: Discounted costs of each policy over 10 years

Policy	Policy costs	Health care costs	Total costs
Baseline	£0	£15,008,250,131	£15,008,250,131
Change4Life	£41,605,237	£14,574,001,919	£14,615,607,156
Labelling	£36,851,600	£14,574,001,919	£14,610,853,519
Reformulation Voluntary	£17,527,929	£14,406,406,793	£14,423,934,722
Reformulation Mandatory - best case	£17,527,929	£14,321,677,353	£14,339,205,282
Reformulation Mandatory - worst case	£500,619,716	£14,321,677,353	£14,822,297,070

The resulting patient numbers and the LYG after the implementation of each policy were calculated using the best effectiveness estimates. The total cost for each policy was then used to calculate the incremental cost for each policy against the baseline of "do nothing".

Table 6 presents the discounted cost of each policy, the discounted costs saved (incremental costs) and LYG over baseline. All policies resulted in a LYG over the baseline of "do nothing" and each policy appeared cost saving against the baseline.

Table 6: Results for each policy compared to baseline over 10 years (lower and upper uncertainty intervals)

Policy	Total cost discounted	Discounted costs saved against baseline	LYG over baseline
Baseline	£15,008,250,131		
Change4Life	£14,615,607,156	£392,642,975	1970 (1,209 – 2,854)
Labelling	£14,610,853,519	£397,396,612	1970 (1,209 – 2,854)
Reformulation Voluntary	£14,423,934,722	£584,315,409	14593 (9,000 – 21,049)
Reformulation Mandatory - best case	£14,339,205,282	£669,044,849	19365 (11,967 – 27,887)
Reformulation Mandatory - worst case	£14,822,297,070	£185,953,062	19365 (11,967 – 27,887)

Results from sensitivity analysis

The minimum and maximum effectiveness estimates from Table 1 were used in the model to show the potential outcomes from each policy. The analysis was performed using the same methods as for the best estimates to calculate total costs and LYG. Using these estimates for each policy, total and discounted cost of each policy, the minimum and maximum discounted costs saved (incremental costs) and LYG are shown in tables 7 and 8.

Table 7: Results for each policy using the minimum estimates over 10 years (lower and upper uncertainty intervals)

Policy	Total Cost Discounted	Discounted costs saved against baseline	LYG
Baseline	£15,008,250,131		
Change 4 Life	£14,637,168,381	£371,081,751	984 (606 – 1,424)
Labelling	£14,632,414,744	£375,835,387	984 (606 – 1,424)
Reformulation - voluntary	£14,555,375,106	£452,875,025	4,902 (3,024 – 7,085)
Reformulation - mandatory best case	£14,484,331,440	£523,918,691	9,758 (6,030 – 14,080)
Reformulation - mandatory worst case	£14,967,423,227	£40,826,904	9,758 (6,030 – 14,080)

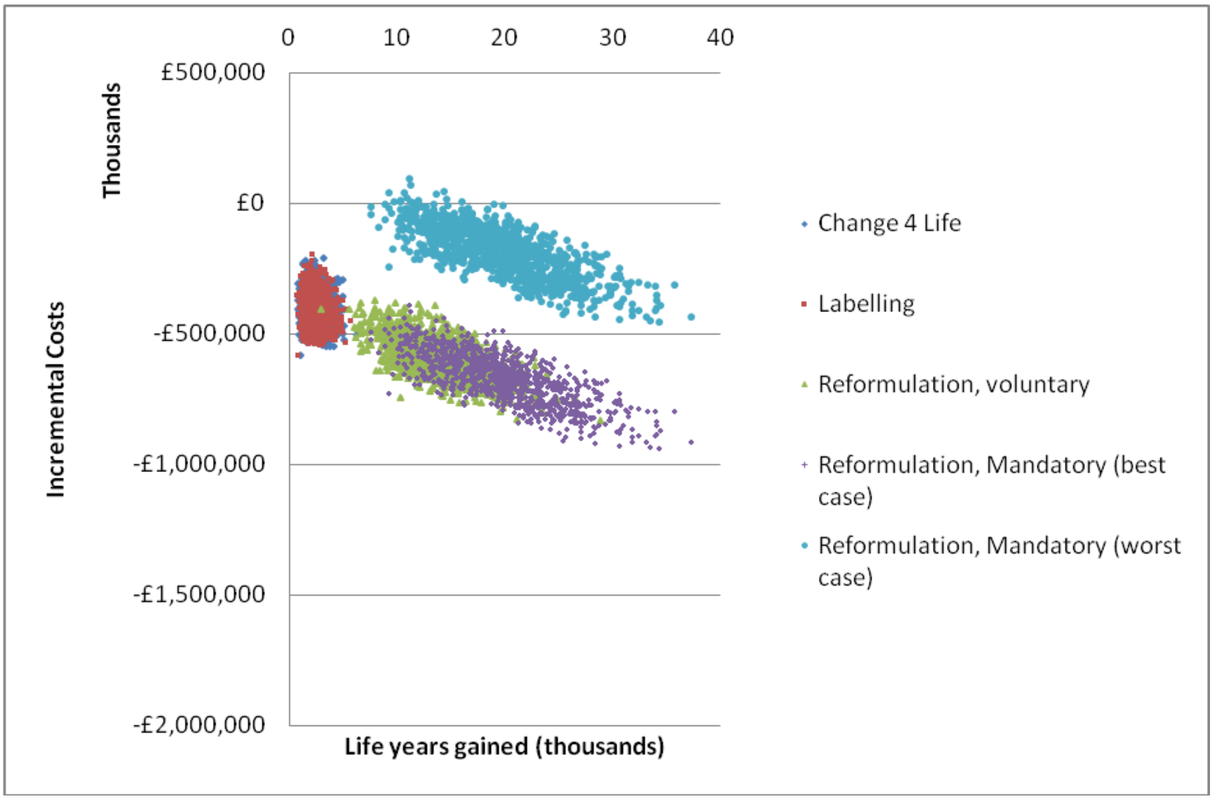
Table 8: Results for each policy using the maximum estimates over 10 years (lower and upper uncertainty intervals)

Policy	Total Cost Discounted	Discounted cost savings against baseline	LYG
Baseline	£15,008,250,131		
Change 4 Life	£14,579,775,398	£428,474,733	4,902 (3,048 – 7,080)
Labelling	£14,575,021,762	£433,228,369	4,902 (3,048 – 7,080)
Reformulation - voluntary	£14,346,237,671	£662,012,461	19,332 (12,084 – 27,787)
Reformulation - mandatory best case	£14,186,428,342	£821,821,789	30,582 (19,198 – 43,813)
Reformulation - mandatory worst case	£14,669,520,129	£338,730,002	30,582 (19,198 – 43,813)

Results from uncertainty analysis

The cost-effectiveness plane shows the output from the uncertainty analysis and plots the difference in life years gained per patient against the difference in cost per patient. The outputs of the probabilistic model are plotted in figure 1 showing the distribution over the incremental cost, incremental effect and the joint cost-effect distribution.

Figure 1: Cost-effectiveness plane, incremental life years gained against incremental costs.



From this we can show that all the policies are cost saving. Only a few points on the distribution show a positive cost per life year gained for mandatory reformulation using the worst case costs associated with the costs to industry.

Discussion

Policies to reduce dietary salt intake across England offer an effective strategy for reducing coronary heart disease events and increasing life years. They could thus potentially reduce future expenditure on health care. The biggest estimated savings came from mandatory reformulation, particularly when assuming a minimal cost for the private sector. This suggests that implementing legislation to reduce dietary salt in processed foods offers a valid way to substantially decrease spending on health care for coronary heart disease. Furthermore, the continuing work in progress between the FSA and the food industry could also result in further savings on health care expenditure in the future. Although Change4Life and labelling of food packaging had smaller effectiveness estimates and gained fewer life years, they still appear cost saving compared to the baseline, and might represent useful components of a comprehensive strategy aiming to maximise public health gains from salt reduction.

Strengths and Limitations

Analysis of UK policies that are already in progress allows us to reinforce the evidence base surrounding population health interventions. It has also enabled us to obtain actual cost data for each policy intervention and effectiveness estimates for reformulation and Change4Life. We have also included the majority of the English population for this analysis including all adults aged 25+ years; which allows us to better capture the overall benefit from these interventions. The use of probabilistic sensitivity analysis allows us to account for uncertainty in our parameters and outcomes, and to generate minimum and maximum estimates in the model to show a range of the potential outcomes. This model focuses on health events related to coronary heart disease. However, a reduction in diabetes and other chronic diseases could also occur (29); the total gains may therefore be greater than the current estimates.

There is inevitably some uncertainty surrounding the costs for voluntary reformulation and the issue of how best to include costs to the food industry. These costs were not included in the FSA Impact Assessment which reasonably assumed that these costs would be absorbed in the rolling process of continuous product reformulation. However, we wanted to show the overall potential costs from reformulation using legislation; using two estimates with and without the cost to the food industry thus allows us to account for much of this uncertainty. The model assumes a single step change in policy, moving in one year from the baseline of "do nothing" to a fully implemented policy in the next year. In reality, there is likely to be a phased implementation over time with dietary salt levels reducing over time. Similarly, the patient numbers were assumed to remain the same in subsequent years, which is likely to represent an over-estimate. The study does not consider the future health care costs of people living longer due to avoiding or postponing a CHD event. It also does not consider the implications of the difference in taste of the foods and consumers preferences for those foods. There is good evidence to suggest consumers do not notice salt reductions in products when the reductions are spread over a 12 month period. People's taste buds gradually become accustomed to the change in salt content (30). However observations of real patient cohorts suggest that longevity delays health care costs rather than increasing the total (31) . Finally, because the policies have similar effectiveness estimates, it is difficult to distinguish the different options from the cost-effectiveness plane figure. However this does demonstrate that policies are cost-saving.

Comparisons with other studies

Our findings are consistent with results from other modelling studies. Another UK study by Barton et al (11) using a very different methodology, estimated that a 3g reduction in dietary salt intake could save about £40 million per year. The vast majority of studies which analyse population health interventions to reduce dietary salt intake have found that these types of interventions can be cost saving by substantially reducing the number of CHD events (9,10,32-35). Many of these other studies use disability adjusted life years (DALYs) as the health outcome measure. Although we are therefore unable to directly compare LYG and DALY results, the majority of the studies consistently found that population health interventions to reduce salt were cost-effective or cost saving. The level of cost saving is dependent on the cost of the intervention which will vary across different settings. For example, the North Karelia project in Finland showed the cost of the intervention as ranging from $5 to $17 per head, this resulted in the project ranging from cost saving (dominant) up to $5900 per QALY depending on the costs used for the intervention (7). In our study, the use of the best and worst case cost for mandatory reformulation highlights this issue where the cost savings are substantially reduced with the inclusion of cost estimates supplied by the food industry (which might sometimes be inflated). In America, Bibbins-Domingo et al (10) estimated that dietary salt reduction of up to 3g per day might result in 60,000 fewer CHD cases, approximately 32,000 fewer strokes, 54,000 fewer myocardial infarctions and 44,000 total deaths annually. Another US study (36) suggested that a 4g reduction in dietary salt intake to 6g/day (the recommended maximum for adults in America) might reduce the hypertension prevalence by 28%, representing 11 million fewer cases in the American population.

Policy implications

The UK government, FSA and NICE have all highlighted the need to reduce dietary salt intake and have taken the first steps. Similar moves are now happening in many other countries. In Canada, the issue of dietary salt is highlighted by the recent bill passed in 2012 called “Sodium Reduction Strategy for Canada”

(37). In Europe, regulations have already been passed in Finland, Portugal and Hungary and are being actively considered elsewhere (38). The use of population health interventions could reduce health care costs in the future and thus reduce the burden on the health care system in England and Wales. These results may be comparable in Scotland given the similarities in cardiovascular epidemiology and therefore could reduce the burden on the health care system in Scotland.

Conclusions

Population health interventions which effectively reduce dietary salt intake in the English population could substantially decrease health care expenditure and reduce the burden of cardiovascular disease.

Mandatory reformulation of processed foods might achieve the biggest reductions in dietary salt intake and therefore the largest savings.

These findings are reassuringly consistent with earlier studies from the UK and elsewhere.

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