Population strategies to decrease sodium intake and the burden of cardiovascular disease: a cost-effectiveness analysis

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study assessed the costs and health outcomes of two strategies to reduce sodium intake to prevent hypertension, heart attacks, and strokes in the general population. Either of the two strategies could significantly reduce cardiac events, increase quality-adjusted life-years, and reduce medical costs. Voluntary sodium reduction by manufacturers was likely to be more effective than a sodium tax. The methods seem to have been appropriate and the results were satisfactorily reported. The conclusions appear to be appropriate.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
The aim was to assess the costs and health outcomes of two strategies to reduce sodium intake for the prevention of hypertension, heart attack, and stroke in the general population. A hypothetical cohort of men and women aged 40 to 85 years, based on the general US population, was studied.

Interventions
The status quo was compared with two strategies: government collaboration with food manufacturers to voluntarily reduce sodium in processed foods, and the introduction of a sodium tax. Voluntary reduction by manufacturers to predefined targets was modelled on the UK experience in 2008.

Location/setting
USA/primary prevention.

Methods
Analytical approach:
A Markov model was used to synthesise published data from sources that included large US epidemiological surveys and meta-analyses. The model analysed data over a lifetime horizon. The authors stated that the study took a societal perspective.

Effectiveness data:
The effectiveness outcomes were the decrease in systolic blood pressure (SBP) and the relative risks of myocardial infarction, stroke, and death. It was assumed that voluntary reduction by manufacturers would decrease the population's sodium intake by the same amount as it did in the UK and the data were from UK published reports. The sodium tax strategy was assumed to be similar to tobacco taxes and the data were based on a published study of cigarette tax. The link between reduced sodium intake and the risk of cardiac events was estimated from relevant published studies. Published meta-analyses on blood pressure and cardiovascular disease were used to calibrate the data. Background population risk data were from the Framingham Heart Study and the Cardiovascular Health Study, with risk assumptions made for those with a prior history of cardiovascular events.

Monetary benefit and utility valuations:
The health-state values were from two published studies of patients with myocardial infarction or stroke. These studies used the Health Utilities Index (HUI) and time trade-off methods.
Measure of benefit:
The measures of benefit were myocardial infarctions and strokes averted, life-years saved, and quality-adjusted life-years (QALYs). Discounting was applied at an annual rate of 3%.

Cost data:
The direct medical costs included the resources used after a myocardial infarction or stroke. The costs were from the household component of the 2006 Medical Expenditure Panel Survey and the events were from published literature. The costs were discounted at 3% annually, reported in US dollars ($), and adjusted to 2008, using the US Consumer Price Index.

Analysis of uncertainty:
One-way and two-way sensitivity analyses were undertaken for the key variables, such as the reduction in sodium intake, the utility scores, the costs, and the cardiac events. A probabilistic sensitivity analysis was conducted.

Results
Voluntary reduction by manufacturers decreased the sodium intake in the population by 9.5% decreasing the mean SBP by 1.25mmHg, while a sodium tax decreased sodium intake by 6% and mean SBP by 0.93mmHg. Over a lifetime, voluntary reduction averted 513,885 strokes, and 480,358 myocardial infarctions, and gained 1,317,709 life-years. Sodium tax averted 327,892 strokes, and 306,137 myocardial infarctions, and gained 840,113 life-years.

Voluntary reduction was associated with 2,060,790 QALYs and sodium tax was associated with 1,313,304 QALYs. The medical cost savings were 32.1 billion with voluntary reduction and 22.4 billion with sodium tax.

The results were stable to most variations in the key estimates, and cost-savings remained for either strategy, except when the utility associated with reduced sodium intake was lowered. When no loss of utility was assumed with a reduced sodium diet, the probabilistic sensitivity analyses showed that QALYs were gained and cost savings made in 98% of simulations with voluntary reduction by manufacturers.

Authors' conclusions
The authors concluded that either of the two strategies to reduce sodium intake was likely to significantly reduce cardiac events, increase QALYs, and reduce medical costs. Voluntary reduction by manufacturers was likely to be more effective.

CRD commentary
Interventions:
The authors gave a brief description of the two strategies, which appear to have been appropriate comparators. The references for the UK experience should be consulted for further details on the two strategies.

Effectiveness/benefits:
The effectiveness data appear to have been of high quality and were calibrated using a relevant meta-analysis, but no systematic review of the literature was reported and it is unclear if all the best relevant evidence was included. Little information was provided for the measures of benefit and information on the utility measures and values would have been useful. The benefit measures were appropriately discounted.

Costs:
The details of the resource types, their values, and the unit costs were briefly provided and the relevant source publications should be consulted to assess their quality. The authors stated that a societal perspective was taken, but only the direct medical costs were reported and productivity losses should have been included. The resources involved in administering a sodium tax or voluntary reduction scheme were not included and might make the findings less representative of the true cost savings. The costs were appropriately discounted and adjusted for inflation.

Analysis and results:
The modelling and health-state transitions were well presented, including the structure of the model, its validation, and calibration. The incremental costs and effects over no intervention were reported clearly in a table, but the two
strategies were not explicitly compared in an incremental analysis, which would have been informative. Appropriate sensitivity analyses were conducted and a discussion of many study limitations was provided.

**Concluding remarks:**
The methods seem to have been appropriate and the results were satisfactorily reported. The conclusions reached by the authors appear to be appropriate.

**Funding**
Support received from the Department of Veterans Affairs, Stanford University, and the National Science Foundation.

**Bibliographic details**

**PubMedID**
20194225

**DOI**
10.7326/0003-4819-152-8-201004200-00212

**Original Paper URL**
http://www.annals.org/content/early/2010/02/25/0003-4819-152-8-201004200-00212.abstract

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adult; Aged; Aged, 80 and over; Blood Pressure /physiology; Computer Simulation; Cost-Benefit Analysis; Diet, Sodium-Restricted; Fast Foods /economics; Female; Humans; Male; Markov Chains; Middle Aged; Models, Cardiovascular; Myocardial Infarction /epidemiology /physiopathology /prevention & control; Nutrition Policy; Quality-Adjusted Life Years; Risk Factors; Sodium, Dietary /administration & dosage /economics; Stroke /epidemiology /prevention & control; Taxes; United States

**AccessionNumber**
22010000847

**Date bibliographic record published**
04/08/2010

**Date abstract record published**
09/03/2011