



Economic Evaluations of Diet and Supplementation

DR MICHELE SADLER, CONSULTANT NUTRITIONIST

DIRECTOR, RANK NUTRITION LTD

Spending on health



- ▶ Growing population
- ▶ Ageing population – next 15 years +4.4 million 65+ years; +1.3 million 85+ years
- ▶ Increasing treatment costs – spending on chronic diseases expected to double in next 15 years
- ▶ Increasing expenditure on drugs – rises by 5% each year
- ▶ Technological developments
- ▶ Medical advancements

All add to pressure for increased spending on the NHS:
Recent announcement: Extra £20bn a year by 2023
Average annual funding increase of 3.4%



Policy options

- ▶ “Brexit dividend”
- ▶ Increase taxes
- ▶ Increase borrowing
- ▶ Reduce services
- ▶ Privatisation
- ▶ Cut other public services
- ▶ Improve NHS productivity

Institute for Fiscal Studies Report May 2018

- Proposed tax rises of up to 2.6% of national income (£34-£56 **billion in today's terms**) required by the mid 2030s
- Additional rise of 0.4% of national income to meet the pressures on social care

Reduce demand for health services?

- ▶ Lifestyle:
 - Improved diet
 - Stopping/reducing smoking
 - Increasing physical activity
 - Reducing over-consumption of alcohol
 - Reducing recreational drug use
- ▶ Personal responsibility
- ▶ Self-help



Diet and chronic disease

- ▶ Role of diet in prevention of diet-related diseases is well-established
- ▶ Dietary guidelines aimed at promoting good health
- ▶ Healthy diets - make an important contribution to health maintenance
- ▶ UK Eatwell Guide – Food-based dietary guidelines for general population from age 2+ years



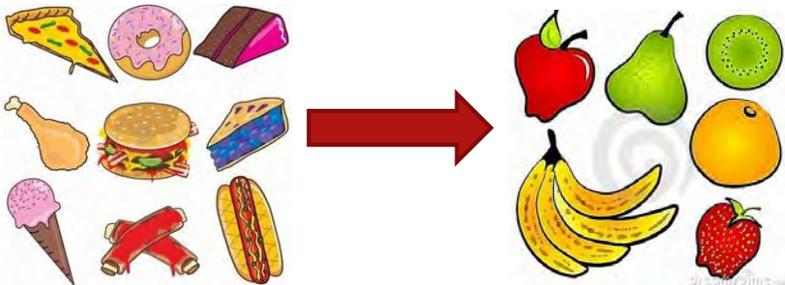
Economic burden of ill health due to lifestyle choices

- ▶ Estimated economic costs to the UK NHS for 2006-2007
- ▶ Of risk factors for chronic disease: CHD, diabetes, cancers, arthritis, cirrhosis, dental caries etc
- ▶ **£5.8 billion:** Ill health related to poor diet
- ▶ **[£5.1 billion:** Overweight and obesity]
- ▶ **£3.3 billion:** Smoking
- ▶ **£3.3 billion:** Alcohol consumption
- ▶ **£0.9 billion:** Physical inactivity
- ▶ Of behavioural risk factors poor diet had highest impact on NHS budget, followed by alcohol consumption, smoking and physical inactivity
- ▶ Good diet and nutrition has potential for vast cost savings for the NHS

Scarborough et al, 2011.
The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006-07 NHS costs. J Publ Health 33 (4) 5278-535.

Potential impact of a simple dietary change

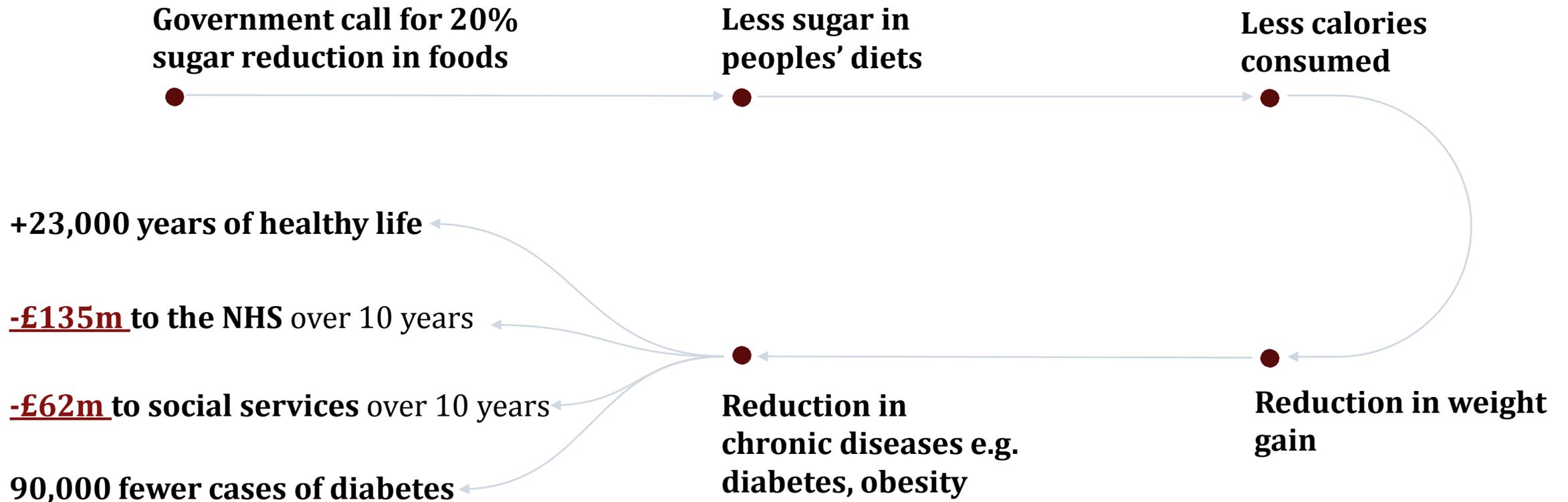
- ▶ Lloyd-Williams et al, 2007 calculated the potential public health impact of replacing one 'unhealthy' snack with one 'healthy' snack per person per day across the UK
- ▶ Calculated the expected changes to dietary intake ➔ impact on blood cholesterol and salt levels ➔ CHD and stroke mortality
- ▶ This might prevent ~6000 cardiovascular deaths every year in the UK
- ▶ Represent a large cost saving to the NHS



Lloyd-Williams et al, 2007. Small changes in snacking behaviour: the potential impact on CVD mortality. *Public Health Nutrition* 2007, 12(6): 871-876.

Potential impact of the Sugar Reduction Strategy

Data courtesy of
Dr Ben Amies,
Manchester



Micronutrients and economic evaluations

- ▶ Scientific literature includes economic evaluations for benefits of supplementation with micronutrients, and long chain omega-3 fatty acids
- ▶ Investigate impact of supplementation on health care expenditure in a target population
- ▶ Insight into relative costs and associated health gains
- ▶ Summarised as estimates of cost-effectiveness or cost savings

Example: Vitamin D and falls

- ▶ Vitamin D supplementation shown to reduce falls in older people – has authorised EU health claim - effective, well-tolerated and affordable
- ▶ A third 65+ year-olds and half 80+ year-olds fall at least 1/year ➡ injuries & fractures
- ▶ Costs to the NHS estimated at over £2billion and over 4 million bed days (Fenton, PHE Blog, 2014)
- ▶ Due to ageing population, annual direct costs arising from falls in 65+ year olds predicted to rise substantially
- ▶ Economics of therapeutic intervention have been investigated

(Bischoff-Ferrari HA & Sadler M, 2018. Authorised EU health claim for vitamin D and reduced risk of falls. In *Foods, Nutrients and Food Ingredients with Authorised EU Health Claims*, Volume 3. Ed. M. J. Sadler. Woodhead Publishing, 2018, Chapter 4, 49-63)

Evaluation: 3-Step process

1. Efficacy assessment (benefit) for health relationship between micronutrient and outcome of interest – efficacy assessed from human trial data, cohort studies, meta-analysis, modelling
2. Clinical benefit – predict change in number of clinical events, prevalence of deficiency etc
3. Estimate costs – modelling of cost savings/cost effectiveness arising from intervention with the micronutrient

Reliability of economic evaluations

- ▶ Depends on accuracy of data/estimates at each step
- ▶ E.g. Effectiveness - strength of evidence for health benefits – EU authorised health claim? Trial data vs observational (cohort data)?
- ▶ Sensitivity analysis – used to quantify uncertainty around the results
- Use alternative, more/less challenging, evidence-based values to show the range of possible results
- ▶ Quality of reporting of the evaluation - transparency

What data is there for micronutrients?

- ▶ Systematic review of peer-reviewed literature
- Explored economic evaluations of potential benefits of micronutrient or long-chain omega-3 fatty acid supplementation
- Literature search
- Relevant studies – peer-reviewed papers, from 2000 onwards, in developed countries, investigated health benefit of dietary supplementation and evaluated direct or indirect costs of dietary-related disease/disorder
- Outcome of interest: potential for cost savings or cost effectiveness
- Narrative review - meta-analysis (pooled statistical analysis) not possible due to different interventions & outcomes, different approaches to costs assessment, different ways results expressed

Results: Overview of included papers

Clinical outcome	Intervention / Supplement	Papers
Reduction of neural tube defects	Folic acid	2 (6)
IQ gains in children	Iodine	1 (2)
Reduction of falls in older people	Vitamin D	3 (3)
Reduced hip fracture risk - older people	Vitamin D	1 (1)
Reduction of osteoporotic fractures - primary and secondary prevention	Vitamin K ₂ ; Vitamin D and calcium; Vitamin D, calcium and vitamin K ₂ ; Vitamin D, calcium and vitamin K ₂	3 (6)
Survival following heart attack; reduction of secondary CV events	DHA/EPA	2 (3)
Reduction of morbidity from infections	Commercial multivitamin/mineral supplement	1 (1)
	TOTAL	13 (22)

CHEERS !!

- ▶ Quality of reporting of economic evaluations varies widely
- ▶ Consolidated Health Economic Evaluation Reporting Standards (CHEERS): 24-item checklist for reporting health economic assessments, e.g.
 - Details of specific question the analysis set out to address
 - Explain why chosen time horizon was appropriate
 - Details of costs estimates – study vs model-base – reasons for choosing model
 - Currency, date/years, costs adjustments method
 - Details of assumptions
 - Full disclosure of values and ranges for all study parameters
 - Discussion of generalisability of the results
 - Disclosure of the funding source



Husereau et al. 2013. Consolidated Health Economic Evaluation Reporting Standards (CHEERS)--explanation and elaboration: a report of the ISPOR Health Economic Evaluation Publication Guidelines Good Reporting Practices Task Force. Value Health. 16(2):231-250.

Data synthesis

- ▶ Each of the 13 papers were scored against CHEERS checklist to assess quality
- ▶ 5 papers good quality; 7 papers lower quality; 1 paper poor quality
- ▶ Also examined quality based on the strength of the evidence used for efficacy and validity of costs assessments

Findings: Robustness of efficacy data

- ▶ 3 health outcomes were supported by robust data for efficacy:
 - Reduced risk of NTD
 - Reduced risk of falls
 - Reduced risk of osteoporotic fractures
- ▶ Supported by comparison with EU list of health claims
- ▶ Other health outcomes were supported by less robust data, and for some evidence of efficacy was tentative e.g. vitamin K and bone fracture

Findings: Predicted costs

- ▶ Most evaluations based costs on multiple sources and data synthesis
- ▶ Some evaluations based costs on a single study
- ▶ In some evaluations costs were taken from a different country to that for which the cost savings were intended
- ▶ Most analyses were based on direct costs only
- ▶ Exceptions were:
 - Monahan et al (2015) - considered special educational costs & monetary value of an IQ point re analysis of iodine supplementation in pregnant women
 - Schmier et al (2006) considered costs for lost productivity due to morbidity & mortality re analysis of long chain omega-3 fatty acid supplementation in men with a history of heart attack

Monahan et al, 2015. Costs and benefits of iodine supplementation for pregnant women in a mildly to moderately iodine-deficient population: a modelling analysis. *The Lancet Diabetes & endocrinology*. 3(9):715-722.

Schmier et al, 2006. The cost-effectiveness of omega-3 supplements for prevention of secondary coronary events. *Managed Care* 15(4):43-50.

Findings: Limitations

- ▶ ~ 1/3rd of analyses reflected scenarios of medical intervention with dietary supplements
- ▶ Others did not cost, or even address, communication of the supplementation strategy
- E.g. reaching the target group could be difficult and costly for people not currently involved with health services
- ▶ In some analyses the intervention strategy involved the health care setting as the supplements were costed as prescriptions (e.g. Poole et al, 2015)

Poole et al, 2015. Cost-effectiveness and budget impact of empirical vitamin D therapy on unintentional falls in older adults in the UK. *BMJ open* 5(9):e007910.

Findings: Cost savings/effectiveness

- ▶ Results were subject to uncertainty, e.g. around
 - Rates of clinical events
 - Prevalence of deficiency states
 - Costs of the intervention
- ▶ Of the 13 included papers, 8 stated that the assessments were conservative

- ❖ 12/13 papers predicted an economic benefit
- ❖ 21/22 evaluations were reported as beneficial or cost effective

In sensitivity analysis when more challenging assumptions were used:

- ❖ Estimates remained cost effective in 6/13 papers

Example: Vitamin D and falls

- ▶ Clinical impact of treating all 60+ years with 800 iu cholecalciferol over a 5-year period would:
 - Prevent in excess of 430,000 minor falls
 - Avoid 190,000 major falls
 - Prevent 1579 acute deaths
 - Avoid 84,000 person-years of long-term care
 - Prevent 8300 deaths associated with increased mortality in long-term care

Example: Vitamin D and falls

- ▶ For reduction in falls alone the intervention is cost-saving
- ▶ Treating all adults 60+ years:
 - Incurs an intervention cost of £2.70bn over 5 years
 - Produces a **-£3.12bn** reduction in fall-related costs
 - Net saving of £420M
- ▶ Increasing the lower bound age limit by 5-year increments increases budget impact to:
 - -£1.17bn for adults 65+
 - -£1.75bn for adults 70+
 - -£2.06bn for adults 75+

Findings: Cost savings/effectiveness

- ▶ Cost-savings not reported for multivitamin/mineral & reduced morbidity from infections Kilonzo et al (2007)
- Based on one trial in 65+ years (mean age 71.5 years) with a time horizon of 12 months
- Questionable whether duration of supplementation was adequate for a significant impact in this age group

Kilonzo MM, Vale LD, Cook JA, Milne AC, Stephen AI, Avenell A, et al. 2007. A cost-utility analysis of multivitamin and multimineral supplements in men and women aged 65 years and over. *Clin Nutr.* 26(3):364-370.

Health benefit – good investment?

- ▶ Gajic-Veljanoski et al, 2012 proposed that:

Where micronutrient supplementation is known to be safe and affordable, *a small health benefit could translate into a good investment* the relationship between predicted costs and benefits, alongside sensitivity analysis, has a potential role to indicate the *expected value of further research, or the expected opportunity loss*.

Gajic-Veljanoski O, Bayoumi AM, Tomlinson G, Khan K, Cheung AM. 2012. Vitamin K supplementation for the primary prevention of osteoporotic fractures: is it cost-effective and is future research warranted? *Osteoporosis International* 23(11):2681-2692.

Conclusions

- ▶ Reliability of estimates from economic evaluations of micronutrient supplements are dependent on the quality of the data input to the modelling
- ▶ Deficiencies in the evidence base for both efficacy and costs are likely
- ▶ Where cost effectiveness can be demonstrated in the clinical setting, it is likely that self-supplementation also contributes to the effect
- ▶ Research into this aspect is warranted
- ▶ The economic benefit of maintaining nutritional status in people with low intakes would also be of interest, against other functional outcome measures

Conclusions

- ▶ The overall finding from the published data that:
 - Many of the analyses reported a cost saving, or
 - Were cost effective against the chosen threshold of acceptability
- ▶ ...suggests a potential role for supplementation with micronutrients and with long chain omega-3 fatty acids:
 - For specific health outcomes
 - Targeted at specific population groups
- ▶ ...in reducing the economic burden on health care budgets
- ▶ These relationships should be explored further
- ▶ Economic evaluation may also be a useful tool to prioritise nutrition research funding on health benefits that are likely to deliver positive impacts for both clinical outcomes and health care budgets

Contact:

Dr Michele Sadler

Director, Rank Nutrition Ltd

Nutrition Science Consultancy

msadler@btconnect.com

www.ranknutrition.com

Registered Nutritionist

Member of the Nutrition Society (Great Britain)

Fellow of the Royal Society of Medicine

Committee Member of SENSE Nutrition Consultants

Member of Nutritionists in Industry

