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Microsimulation model for health economic evaluation of public health policies: an imperfect but useful tool

Olivia Wu PhD
William R Lindsay Chair of Health Economics

Correspondence
Olivia Wu PhD
HEHTA Research Unit, University of Glasgow, 1 Lilybank Gardens, Glasgow G12 8RZ, UK
Email: olivia.wu@glasgow.ac.uk

Affiliation
Health Economics and Health Technology Assessment (HEHTA) Research Unit
Institute of Health & Wellbeing
University of Glasgow

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Fiscal and regulatory policies that target reducing sugar consumption is increasingly being proposed and adopted across different countries. In February 2021, the US National Salt and Sugar Reduction Initiative (NSSRI) revised their sugar reduction targets for packaged foods across 15 food and drink categories. The overall aim was to achieve a 20% reduction in mean sugar content in foods and 40% reduction in drinks by 2026.

As part of the Food Policy Review and Intervention Cost-Effectiveness (Food-PRICE) Project, [1] Shangguan et al conducted a health economic evaluation to determine the cost-effectiveness of a voluntary added sugar reformulation policy to achieving these targets. [2] Drawing on the approaches adopted by the UK government to encourage product reformulation, the authors evaluated the potential value of a voluntary regulation policy consisting of: (1) government implementation and engagement of industry stakeholders in setting voluntary reduction targets; (2) government monitoring and evaluation over implementation period; and (3) industry reformulation.

Compared with the status quo, voluntary regulation to achieve the NSSRI targets was shown to be a cost-effective strategy. Specifically, the policy was considered highly cost-effective (<$50,000 per quality adjusted life year (QALY) gained) by the end of Year 7 following initial implementation, and dominant (additional QALY gains alongside lower costs) by the end of Year 9 following implementation. Over a life-time horizon, the analysis estimated 6.67 million QALYs gained alongside healthcare cost savings of $118 billion. In addition, Shangguan et al applied an equity lens to their health economic evaluation. It is known that exposure to unhealthy diets is unequal across society and contributes to significant health inequalities. The quantification of the differential health gains and cost savings across different population subgroups is an important contribution to the evidence base. These were greater among those who were <65 years (vs ≥65 years), Black and Hispanic (vs non-Hispanic White), with lower income (vs poverty-income ratio ≤1.85), and with lower education (vs ≥ high school education). Overall, the findings of this study make a highly compelling case for the adoption of a national voluntary added sugar reformulation policy.

However, whether this study has presented sufficient evidence for policymaking remains a pertinent question. In the absence of empirical data on the implementation of voluntary reformulation policy in this context, Shangguan et al adopted a microsimulation CVD policy model (CVD-Predict) to estimate cardiometabolic endpoints, QALYs and associated healthcare costs. This approach is not uncommon and there is increasing popularity with the use of microsimulation models in the evaluation of population-based dietary policies. [3] The strength of microsimulation models is their ability to model the complexity between individual risk factors and disease trajectories, but they are also limited by the quality of the data that are used to populate these models and their underlying model assumptions.

The authors used data from several sources that were considered to be best available evidence to inform the model. However, there are inherent limitations to the data used in this study, such as potential recall bias associated with dietary survey data, and issue with confounding when estimating etiologic effects based on meta-analysis of observational studies. In addition, one might argue that few of the key assumptions implemented in the model may have led to over- or under-estimation of benefits associated with the policy.

Firstly, the authors assumed that fully achieving the NSSRI sugar reduction targets through reformulation was feasible. The was based on the assumption that annual sugar reductions of
3% and 6% would be achieved in foods and drinks, respectively, over a period of eight years. However, data from the UK experience reported a disappointing 3% overall reduction in mean sugar content in foods over a period of three years; [4] this was primarily driven by the biggest sugar reduction in categories such as breakfast cereals and yoghurts (13% reduction). In contrast, the soft drinks levy which was introduced in 2018 a significant reduction of 44% in total sugar content was observed for drinks over the same period. Although Shangguan et al were able to show that the policy would remain cost-effective at 50% implementation, this may still be an optimistic scenario for reformulation of food products.

Secondly, it was assumed that any change in added sugar content implemented would equate to change in total sugar intake, and that population diets would remain unchanged over time. However, the mechanism of change to individual behaviour remains widely debated. Reformulation may not result in the intended effects if people simply replace their sugar intake with different sources. It is also not known whether any changes in total sugar intake can be fully attributable to a single voluntary reformulation policy, while discounting other potential influences on behavioural change. For instance, an evaluation of the US Healthy Weight Commitment Foundation (HWCF) pledge to reduce their US calorie sales has shown that in spite of company participation exceeding their pledge to reduce sales of packaged foods, this did not equate to a reduction in calories purchased by consumers. [5]

Thirdly, there has been criticisms on the narrow scope of these models. This was partially addressed by Shangguan et al through broadening the analysis to adopt a societal perspective by incorporating the costs of informal care and productivity loss associated with disease burden. However, the benefits such policies can far extend beyond cardiometabolic outcomes. Indeed, the authors have previously evaluated the impact of a penny-per-ounce national sugar-sweetened beverage sugar policy on cancer outcomes. [6] In the UK, the evaluation of the government sugar reduction policy was across multiple disease areas in children and adults. Amies-Cull et al evaluated the impact of a 20% sugar reduction in a variety of foods on calorie intakes, weight and BMI, and the subsequent reduction in chronic disease incidences (cardiometabolic disease, cirrhosis, and five cancers) as a result from change in BMI. [7] The UK evaluation concluded that all components of the policy – reformulation, portion reduction and sales weighting need to be fully implemented to achieve to estimated benefits.

Evaluation of public health policies are inherently complex and challenging. Randomised controlled trial evidence on effectiveness is often not available or not possible to generate. It is difficult to establish direct causal links between policy and health outcomes; post evaluations of policies are often conducted using natural experiment approaches. However, in the absence of such data, model-based evaluations can make valuable contributions to decision-making. While models are imperfect and there are many ways to make improvements to estimations (e.g. acquiring additional data and using more complex systems approach to modelling), we also need to consider the value of further information to decision making.

Policymaking cannot be based on an instrumental view, in that objective evidence or concrete facts is the sole ingredient to decision making. Overall, there is little uncertainty from the model-based evidence of sugar reduction policies, including that of Shangguan et al, that achieving these sugar reduction targets would lead to health benefits. However, uncertainty remains on how to shape and implement these policies to achieving these targets. Achieving these potential benefits may require efforts beyond voluntary reformulation, such as
government incentives for compliance and enforced sanctions when there is failure to comply; it will be reliant on how industry and consumers respond. A constructive view of policymaking is needed, where evidence and action content lead to constructive negotiation. [8] What is needed to inform policymaking, is a better understanding of the mechanisms for change from the perspective of all stakeholders – the government, the industry and individuals.
REFERENCES


