Exploring policy options in a system dynamics model of childhood and adolescent obesity

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Abstract: Childhood and adolescent overweight and obesity is a major public health challenge. The rise in obesity is a complex issue and is influenced by contributing factors across various settings (such as home, school and community) and a range of biological and social mechanisms (such as metabolic, social normative and behavioural). While childhood and adolescent obesity has been the focus of many public policies, the continued high prevalence highlights the difficulties in developing strategies to prevent obesogenic environments for children and adolescents. This ongoing challenge to address childhood obesity, coupled with the complex nature of prevention alongside the need for greater evidence-based decision making has created a demand for simulation-based decision-support tools to assist in fully understanding the intricate landscape of the issue.

The complex nature of childhood and adolescent obesity requires a systems understanding to incorporate the multi-faceted nature of causal drivers. One approach is system dynamics modelling, which can be used to quantify hypothetical causal structures using mathematical representations of real-world relationships. The goal of system dynamics modelling is to identify and explore the underlying behaviours of complex systems by integrating multiple data sources, research evidence, and expert knowledge to project likely trajectories of population health. These models can be used to explore health policy implications and measure proposed costs and benefits through scenario analysis.

A system dynamics model has been developed with input from expert stakeholders over a series of workshops and contextualised with national population data to reflect the Australian context. This model aims to examine the underlying dynamics of childhood and adolescent obesity in Australia and compare hypothetical intervention scenarios to explore the characteristics that make them successful. This model includes a detailed representation of population epidemiology, energy balance, role modelling, intergenerational effects and behavioural relapse to replicate observed historical data and test health policy. The scope of the model requires a large number of input data. As a result, the model incorporates a broad-scoping uncertainty analysis to ensure the insights reflect the precision of the model input data and assumptions.

The model compares the change in the prevalence of obesity over time within each age-gender-BMI group between the scenario and the counterfactual, business as usual. Scenarios looking at the implementation of interventions in early childhood prevention, childcare centres, school settings, sports participation and the introduction of a sugar-sweetened beverage tax have been considered in the model. The changes in BMI health states were tracked and compared to measure the changing prevalence of child and adolescent overweight and obesity caused by implementing each intervention. Furthermore, the reduced healthcare spending and increased population utility are compared against the hypothetical cost of implementing each intervention to estimate a net benefit.

This presentation describes the model development and corresponding insights derived from the Australian child and adolescent obesity model. The presentation will highlight the model structure, methods for quantifying uncertainty, the reduction in the prevalence of obesity and the net monetary benefit for each scenario analysis. This work provides a comprehensive example of an application of a system dynamics model in public health and demonstrates the strengths of simulation to support health policy decisions.

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