



# Modelling the SWAP IT Lunchbox Program



## Our approach

We used a system dynamics model of child and adolescent overweight and obesity in Australia to examine population level health effects of SWAP IT. This model has been previously used to examine public health policy in Australian settings (1).

We conducted two scenario analyses looking at:

- The health effects based on reductions in kilojoules from lunchboxes at schools.
- Broader changes in total daily energy intake.

## Key Findings

- The greatest impact on childhood obesity was observed in older primary school students who had longer exposure to the program.
- Obesity reductions continue into adolescence but become less pronounced after students leave primary school
- A reduction of 117.26 kilojoules in lunch boxes resulted in modest effects on childhood obesity, with a 0.11 percentage point reduction for males and a 0.08 percentage point reduction for females.
- Broader reductions of 820.8 kilojoules in total daily energy intake resulted in a greater impact on childhood obesity, with a 1.96 percentage point reduction in males and a 1.25 percentage point reduction in females.



## Background

In Australia between 22 and 29 percent of primary school age children are affected by excess weight and obesity. This is nearly double the average in OECD countries (2017 OECD Obesity Update). Poor nutrition is recognised as a major risk factor in Australia with excessive intake of foods high in energy (kilojoules), saturated fat, sugar and salt being key contributors.

More than 85% of school children take a packed lunch to school every day and packed inside are more than three servings of energy-dense, nutrition-poor snack foods. The food children consume at school impacts their concentration, health and wellbeing – now and into the future.

SWAP IT is an effective, low cost, evidence based behavioural change program that improves children's nutrition by supporting parents and carers to improve children's eating habits by helping them to swap out unhealthy lunchbox foods. The program helps reduce the intake of discretionary kilojoules consumed over the school week, like chips, biscuits, cake and fruit juice.

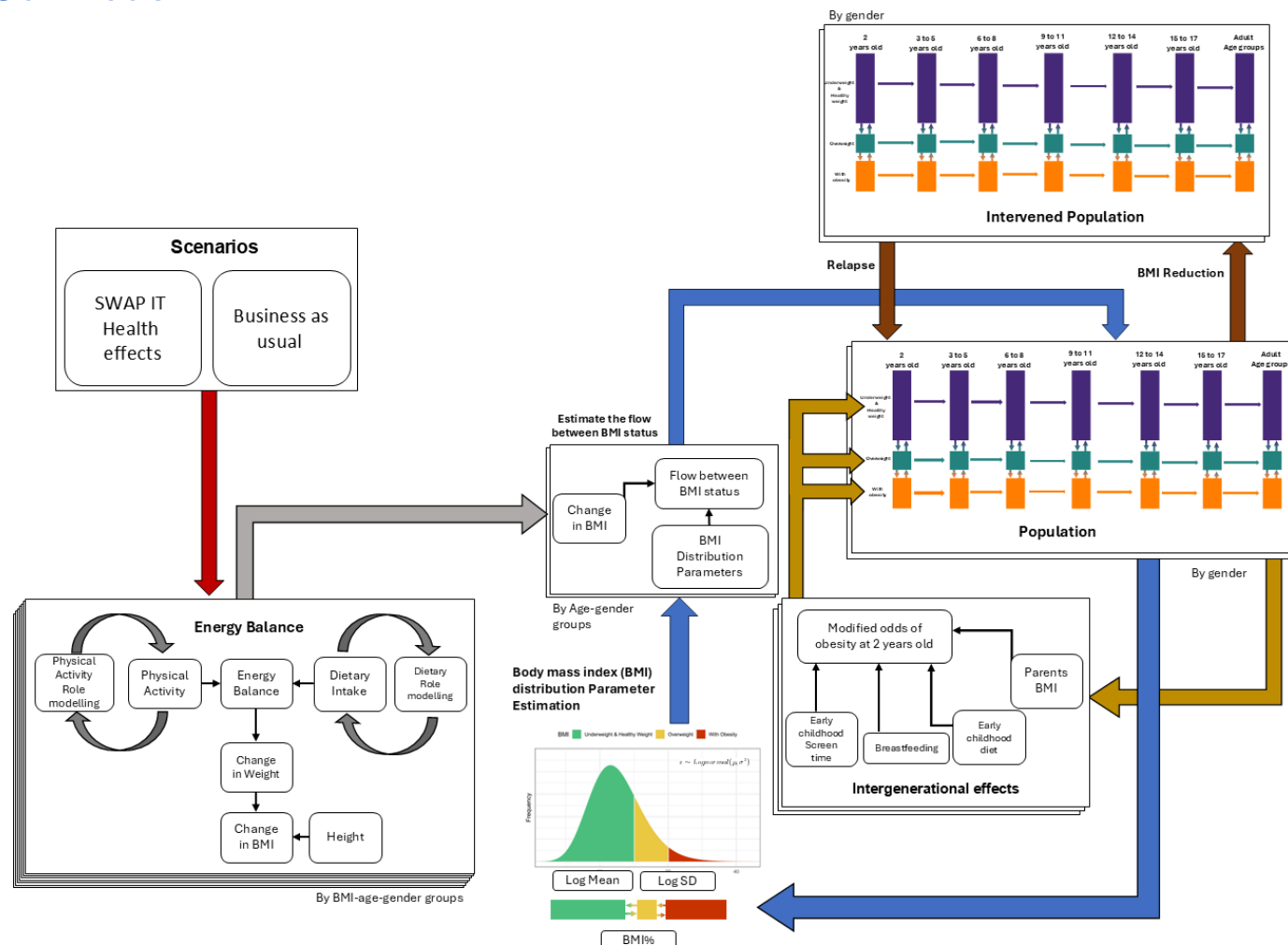
Through a program of research involving 44 schools and 6,525 children, SWAP IT has been found to be effective at reducing unhealthy food in children's lunchboxes. On average lunchbox contents decrease by 117.26 kilojoules (2). Additionally, a food frequency questionnaire indicated an 820.8 kilojoule reduction in mean total daily energy intake, suggesting a broader influence on behaviours beyond the school setting (3).

## Modelling Overview

The system dynamics (SD) model contains five main components:

1. A population component, which tracks changes in the number of people by BMI categories, as well as migration, births, and deaths.
2. An energy balance component, which calculates dietary intake and energy expenditure to estimate the average changes in BMI and behaviours through child-to-child and adult-to-child role modelling.
3. Formulas to calculate age-gender BMI distribution parameters.
4. Formulas to calculate the relationships between energy deficits or surplus and their effect on BMI category.
5. An intergenerational component that predicts the BMI category of children entering the population based on adult BMI rates and typical infant behaviours from birth to 2 years old

The model runs simulations for 30 years to show long-term effects of behaviour changes. SD model was developed and run using ISEE Stella Architect v1.9.3 ([www.iseesystems.com](http://www.iseesystems.com)). Input sampling, analysis and visualisation were programmed using R version 4.3.1.



**Figure 1. Overview of model structure**

## Results

### Changes in Lunchbox Contents

Overall, the impact on population obesity was modest when focused on the change in lunchbox contents. The greatest reduction was observed in the older age groups (9–11-year-olds). The prevalence of obesity in males aged 9–11 years old was expected to be 0.11 percentage points (pp) lower (-0.11, uncertainty range -1.40pp, 0.11pp) at the end of the simulation compared to a scenario without SWAP-IT. This was similar for the female cohort, with 0.08 pp lower (-0.08 pp, uncertainty range -1.18pp, 0.09pp) compared to the base model. This effect wanes as each cohort ages out of primary school. No residual effects were observed past 19 years of age.

### Changes in Daily Energy Intake

A larger impact on the reduction of obesity was observed in the model when considering the potential impact of SWAP IT on overall daily consumption, reported from food frequency questionnaires. The prevalence of obesity for males was projected to reduce by -1.04 pp (uncertainty range: -5.42 pp, 0.11 pp) and -1.96pp (uncertainty range: -9.71 pp, 0.01 pp) for 6 to 8 years old and 9- to 11-year-olds respectively. A marginally smaller effect was observed in females: -0.43 pp (uncertainty range: -5.14 pp, 0.08 pp) and -1.25 pp (uncertainty range: -10.06 pp, 0.02 pp).

## Next Steps



A range of implementation strategies are being considered by schools and local governments to enhance adoptions and provide greater exposure to school children around Australia.

Future research will focus on better understanding the health and cost benefits of each of these implementation strategies. This work will further support governments and health agencies in assessing the impact of SWAP IT and determining how best to implement the program in their local contexts.

## References

- (1) Chiu SK, Baur LA, Occhipinti J-A, Carrello J, Golley RK, Hayes A, et al. Insights from a codesigned dynamic modelling study of child and adolescent obesity in Australia. BMJ Public Health. 2025;3(1):e001164.
- (2) Sutherland R, Brown A, Nathan N, Yoong S, Janssen L, Chooi A, et al. A Multicomponent mHealth-Based Intervention (SWAP IT) to Decrease the Consumption of Discretionary Foods Packed in School Lunchboxes: Type I Effectiveness-Implementation Hybrid Cluster Randomized Controlled Trial. J Med Internet Res. 2021;23(6):e25256.
- (3) Brown A, Sutherland R, Jones J, Barnes C, Janssen L, Nathan N, et al. Can a school nutrition intervention have an impact on whole day total energy intake? [Conference paper]. In press 2024.

## About us

This research is being conducted by researchers at the National Centre of Implementation Science (NCOIS), an NHMRC funded Centre for Research Excellence associated with the University of Newcastle. The research is led by Dr Rachel Sutherland.

## How do I find out more?

Please email the Research Lead Dr Simon Chiu.  
Email: [simon.chiu@health.nsw.gov.au](mailto:simon.chiu@health.nsw.gov.au)

**Prepared by Dr Simon Chiu, Dr Anna Rayward, Dr Jannah Jones, Dr Courtney Barnes, Associate Professor Nicole Nathan, Dr Alix Ivers and Associate Professor Rachel Sutherland.**