The problem

Aotearoa New Zealand has one of the highest rates of childhood obesity in the world. Childhood obesity disproportionately impacts Māori and Pacific children, and those from poorer backgrounds. Left unchecked, obesity in childhood raises the risk of adult health problems including arthritis, diabetes, and cardiovascular disease. Once established, reversing obesity may require simultaneous changes in diet, activity and environment which are difficult to implement and maintain.

Children of mothers who smoked in pregnancy are more likely to be obese – Better Start researchers found a 20% increased risk of obesity at age five for children whose mothers smoked during pregnancy. Moreover, there is evidence that this association is causal, and that the elevated risk persists into adulthood.

If an intervention successfully reduced smoking in pregnancy, how would this impact the prevalence of obesity? And how much would smoking in pregnancy have to reduce in order to have a big effect on obesity? These questions can be answered through simulation modelling. We developed the *Better Start Model* to simulate the impact of different policy changes and interventions, including changes in prevalence of smoking in pregnancy.

Better Start Model (https://compassnz.shinyapps.io/BetterStartModelShiny/)

The Better Start Model uses simulation to model the long-term impact of interventions undertaken as part of the 'A Better Start' National Science Challenge (ABS). The model creates a virtual world of 10,000 individuals[1] – children with characteristics matching those of children born in New Zealand in 2013 – and uses results from interventions targeting literacy, early growth and mental wellbeing to simulate the effects of these interventions.
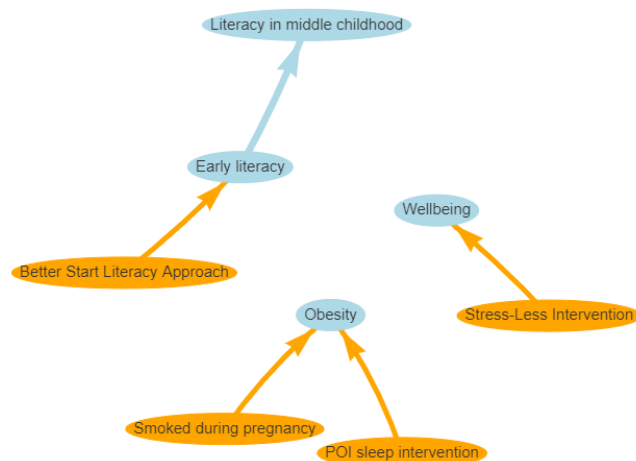

We model the impact of different changes in the prevalence of smoking in pregnancy on obesity both in childhood (ages five and 11) and in early adulthood (age 24).

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[1] These are not real people, but 'synthetic' individuals created by analysing data from the Integrated Data Infrastructure (IDI).
Disclaimer: These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/.

Results

The model allows the impact of many different scenarios to be tested. Two are shown here:
First, *What if the prevalence of smoking in pregnancy was halved?*

The panel to the right shows the results of this scenario. The red bar shows the 'base' scenario – if the prevalence of smoking in pregnancy remains as it is currently (15.3%) while the green bar shows the simulation scenario – where the prevalence of smoking in pregnancy is halved (to 7.65%). The error bars represent the uncertainty from the simulation.
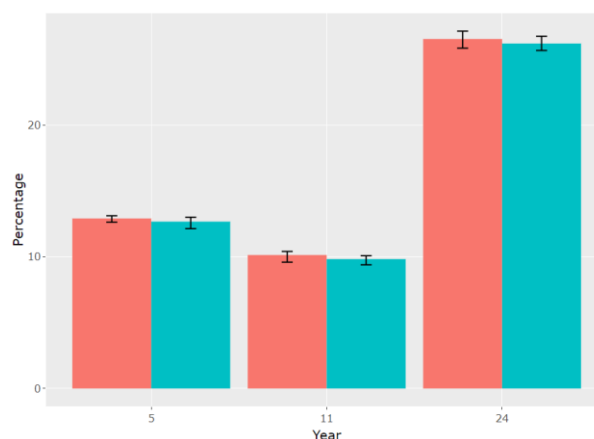
The simulation shows very small changes in prevalence of obesity in the population – reductions of 0.25%-0.35% across ages, equivalent to 150-200 fewer obese children and young adults each year. There are two reasons for this. First, the effect of smoking in pregnancy on later obesity is small – a 20% increased risk. Second, exposure to smoking in pregnancy was unchanged for 92.35% of children, including 7.65% whose mothers were simulated to still smoke in pregnancy, and 84.7% whose mothers were simulated to remain non-smokers. Thus, only 7.65% of children were simulated to have reduced risk.

However, targeted interventions can have greater impact. For example, an intervention focusing on Māori may have greater impact because prevalence of smoking in pregnancy is higher among Māori. This is what the second scenario tests:
What if the prevalence of smoking in pregnancy was halved for Māori?

This results of this scenario are shown in the panel to the right. Here the effects are bigger: prevalence of obesity was reduced by 0.7%-1.1%, equivalent to 120-180 fewer obese Māori children and young adults each year.

Note, scenario 2 targeted Māori only – 28% of children – and prevented nearly as many cases of obesity as scenario 1 which targeted the full population. Thus, a targeted intervention for smoking in pregnancy may prove more cost effective.
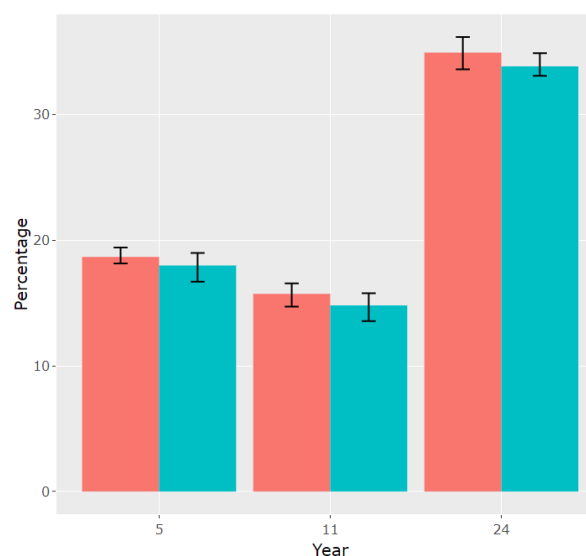
Take home message
A wide range of policy simulations can be run with the Better Start Model, including those targeting a greater or smaller number of people, different population groups, and using varying assumptions. These models are useful for evaluating the impact of different policy options and providing solid evidence for future policy decisions.

Want to find out more?
Check out the model at https://compassnz.shinyapps.io/BetterStartModelShiny/, or contact Barry Milne b.milne@auckland.ac.nz