nesta

An analytical framework for linking calorie targets to obesity reduction outcomes: The case of halving obesity prevalence in England

Dr Elena Mariani, Principal Data Scientist
Hugo Harper, Mission Director
Lauren Bowes-Byatt, Mission Deputy Director

Nesta.org.uk   @nesta_uk

A healthy life

Our mission is to increase the average number of healthy years lived in the UK, while narrowing health inequalities.

At Nesta, we are focusing on halving the prevalence of **obesity** by 2030.

We do this by designing, testing and scaling solutions that drive the change needed: changes in our food environment – the places we shop, the foods we buy, the streets we walk on – to make healthy eating easier and more appealing.

Background

- Excess weight prevalence in England has increased rapidly in the last 30 years
- Research indicates that the obesity problem stems from a small but continuous surplus of calories consumed by the population
- If we want to see a decrease in obesity rates, we need to reverse this surplus of calories by either increasing physical activity or reducing calorie intake.

Research Question

How many fewer calories would adult people living with excess weight need to eat on average to meet the aim of halving obesity prevalence in England with respect to 2019 levels?

Halving Obesity Prevalence

We define halving obesity prevalence in terms of the relative prevalence of BMI values between 30 and 39 (obese but not morbidly obese)
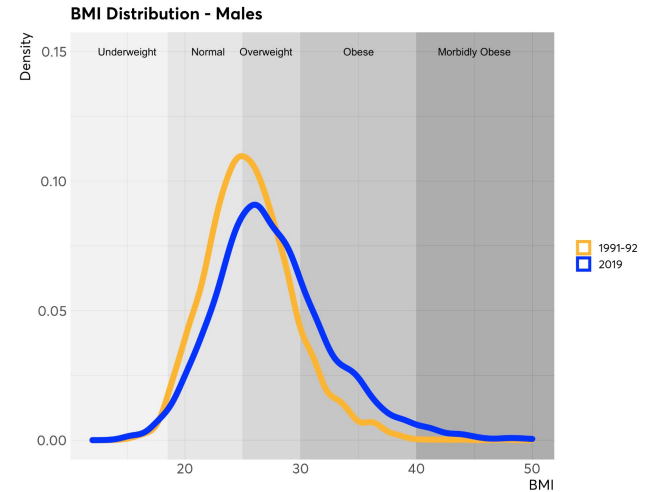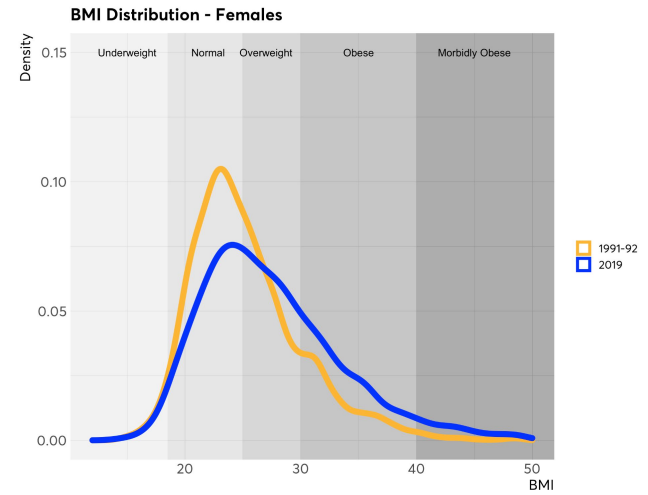
The obesity prevalence in England in 2019 was

24.7% → **~12%**

Halving obesity prevalence means a prevalence rate of

The last time in history that obesity prevalence in England was around 12% was the early 1990s

BMI Distribution - Females

BMI Distribution - Males

BMI distribution by survey year for females and males

Notes: Distribution of BMI from Health Survey for England waves 1991 and 2019. Author's calculations. All figures for 2019 have been calculated using survey weights (wt_int). Survey weights are not available for 1991.

nesta

Definitions

Energy gap

"the term energy gap was created to estimate the degree of change in the energy balance point (the absolute energy intake and expenditure at which balance is reached [i.e. body weight becomes stable]) required for success in body weight goals" (Hill, Peters and Wyatt, 2009 [p.2])

Energy maintenance gap

The energy maintenance gap provides an estimate of how much energy requirements change with weight loss, which in turn, provides an estimate of how much energy balance must be changed for a person to attain and maintain a new, lower body weight.

Hill, James O., John C. Peters, and Holly R. Wyatt. 2009. 'Using the Energy Gap to Address Obesity: A Commentary'. *Journal of the American Dietetic Association* 109(11): 1848–53. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796109/ (June 1, 2022).

nesta

The Hall model is a biomathematical model to predict changes in body weight

Hall Model

- A popular rule of thumb in public health evaluations is that **0.45 kg are lost for every 3500 kcal** cut down from diets
- Hall showed that the rule of thumb is an overestimate of the actual amount of weight loss
- Hall built a dynamic mathematical model that considers how weight change depends on physiological processes and individual characteristics
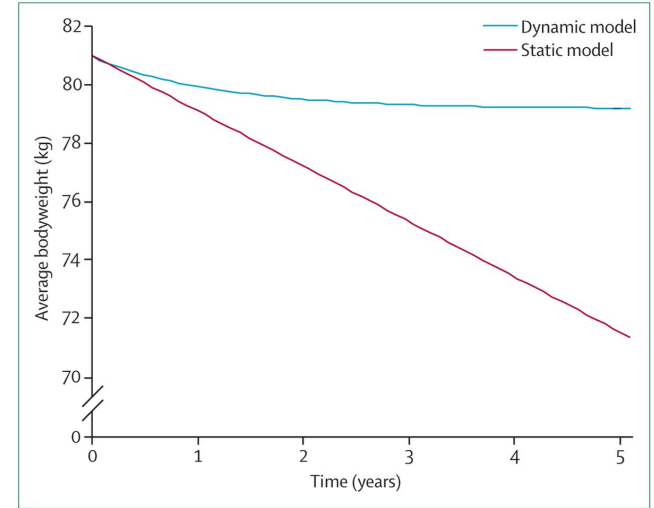

Figure 6. Prediction of the effect of a policy intervention on the population average weight Simulated average weight change of a 20% tax on caloric sweetened beverages. The average energy-intake change was specified in a recent report by the US Department of Agriculture (USDA)[12] and initial population average weight of 81 kg corresponded to the most recent measurement in the USA. Rather than produce the progressive weight loss predicted by the static model, the same decrease of energy intake led to a simulated modest weight-loss plateau.

Hall, K. D., Sacks, G., Chandramohan, D., Chow, C. C., Wang, Y. C., Gortmaker, S. L., & Swinburn, B. A. (2011). Quantification of the effect of energy imbalance on bodyweight. *The Lancet*, *378*(9793), 826-837.

nesta

BMI group	Females		Males	
	kcal/day	% reduction	kcal/day	% reduction
Overweight	136 kcal/day	-6.5%	187 kcal/day	-6.9%
Obese	222 kcal/day	-9.6%	307 kcal/day	-10.3%
Morbidly Obese	395 kcal/day	-13.7%	531 kcal/day	-14.8%
Excess Weight	**190 kcal/day**	**8.5%**	**241 kcal/day**	**8.5%**
Population*	115 kcal/day	-5.4%	165 kcal/day	6.0%

Notes: * The population level figure is calculated under the assumption of no change in intake for the underweight and healthy weight groups. This figure is reported as a useful benchmark for monitoring calorie reduction progress, as figures for calorie consumed or purchased are more easily available at whole population level and figures for subgroups cannot be estimated accurately.

nesta

Validation

BMI Categories Distribution

Population
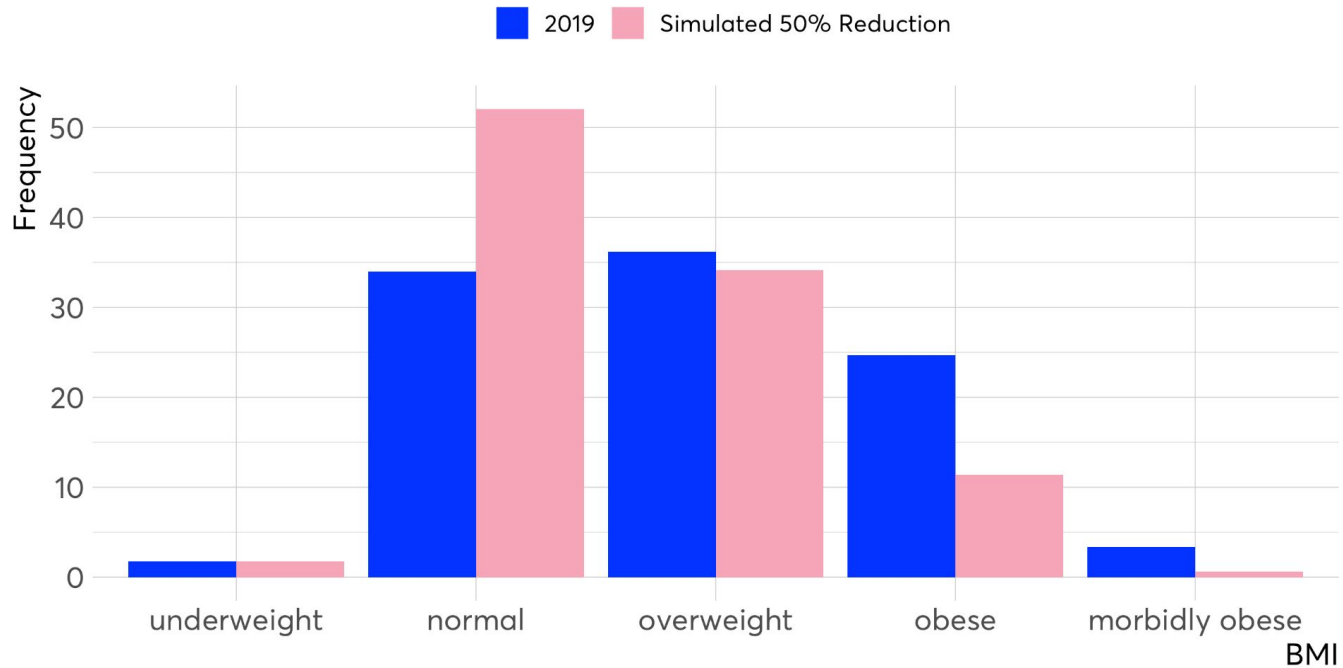
Summary

- This study aimed to determine how many fewer calories people in England need to consume in order to effectively address the obesity problem.
- Its main purpose is to give us an idea of how big the challenge is and provide a standard for measuring policies and interventions.
- Building on this project, Nesta is currently working on building an interactive tool aimed at policy makers where the impact and success of food environment interventions is assessed against this benchmark.

nesta

Thank you!

elena.mariani@nesta.org.uk

Publication available on OSF
https://osf.io/ewb84/

Github repo
https://github.com/nestauk/ahl_weight_loss_modelling