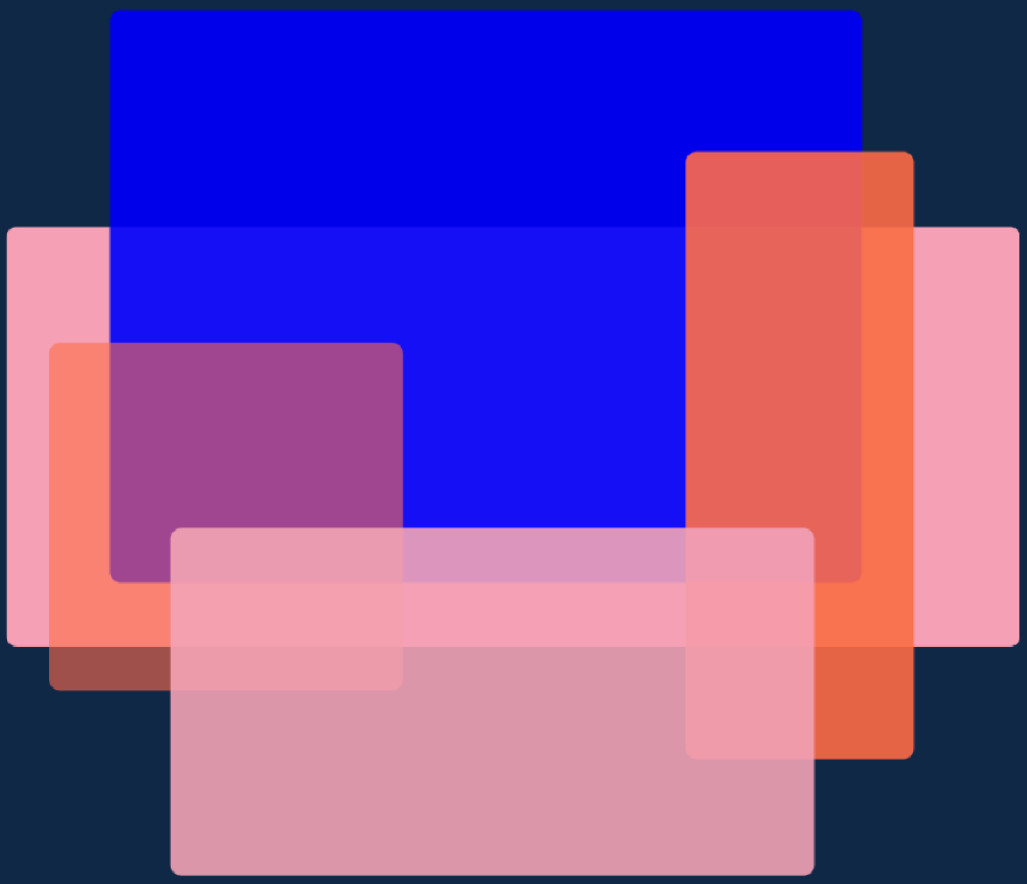
Blueprint
by nesta

Blueprint for halving obesity: rapid review

Universal free school meals in primary school



Author: Darren Hilliard

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Summary table

Title	Impacts of local authority universal free school meal schemes on child obesity and household food expenditure	Going universal. The impact of free school lunches on child body weight outcomes
Author and year	Holford, A. and Rabe B. (2022b)	Holford, A. and Rabe B. (2022a)
Type of study	Quasi-experimental: Difference-in-difference study	Quasi-experimental: Difference-in-difference study
Outcome variable	Average body weight	Average body weight
Treatment	Universal Free School Meals for primary school children	Universal Infant Free School Meals for Reception Year children
Control	No exposure	No exposure
Magnitude of effect (Adults)	Not in scope of study	Not in scope of study
Magnitude of effect (Children)	1.3 to 1.4 percentage point reduction in obesity from a baseline of 25% in Year 6	4.1% of a standard deviation reduction in BMI z-score, corresponding to an absolute weight change of 63g for boys and 73g for girls
Notes	For modelling the impact of this policy, the review highlighted in the green column was used.	

Rapid umbrella review

Background

Evidence suggests that school lunches are considerably more healthy than packed lunches. School lunches in the UK are covered by regulatory standards which mandate that they meet specific nutritional requirements. The specific requirements differ between the four nations; however, both England and Wales require that primary school lunches do not exceed 530 calories per day. A 2010 study found that only 1.1% of UK packed lunches met the English standards and they averaged 624 calories (94 calories more than permitted for school meals). Another study showed that primary age children in the UK that ate school lunches between 2004 and 2014 consumed less energy, more protein and fibre (both of which has been shown to keep you fuller for longer, preventing snacking later in the day), and less sugar and saturated fat, than those that ate packed lunches. And a more recent study found that packed lunch quality in English schools decreased over the 10-year period from 2006-2016. Similar outcomes were observed in the US following the introduction of nutritional standards for US schools, including improved diet and reduced BMI.

In addition, food eaten in school is an important part of children's diets, making up 17% of meals and snacks eaten by primary school children. As children obtain a significant portion of their food energy during school hours, utilising school meal programmes emerges as a clear policy tool for enhancing the prevalence of healthy weight in children (Holford and Rabe, 2022a).

Objective

To summarise the best available evidence on free school meals on outcomes relevant to calorie consumption, weight loss, obesity and general health.

Methods

We aimed to identify reviews that included quantitative research synthesis (ie, meta-analysis) of the effect of free school meals on obesity and calorie

consumption. If more than one review was identified that answered our research question, we aimed to identify the review that was reflective of the best evidence, based on (a) suitability of the outcome to our research question, (b) year published, and (c) quality of review (judged by JBI checklist).

Eligibility criteria

Types of review. To be eligible for inclusion, articles were required to use systematic review methodology (ie, use of systematic search and inclusion strategy to identify all available studies) and include quantitative data synthesis (ie, meta-analysis) of multiple studies that examined the effect of school meals on outcomes of interest. If the search did not identify any studies where a meta-analysis had been conducted due to heterogeneity of outcomes of interest, we included reviews with narrative synthesis. We did not set inclusion criteria on the number or type of databases searched.

Participants. We prioritised findings from reviews of UK-based studies; however, if a sufficient systematic review was not available, we included studies from outside the UK.

Intervention. Reviews had to synthesise studies that examined the effect of children eating school meals compared to children eating packed lunches and/or the rollout of universal free school meals.

Outcomes. To be eligible for inclusion, reviews had to include BMI, weight, body composition, or food intake as an outcome.

Information sources and article selection

The search strategy was designed to identify syntheses of research evidence such as systematic reviews between the year 2010 and the date of search. Initial keywords were identified via a scoping review of relevant papers and reports and via MEDLINE using the MeSH function. A search was performed in MEDLINE and the Cochrane Database of Systematic Reviews (see appendix 1 and appendix 2 respectively for search strategies). We searched grey literature on the Cochrane Database, Informas, Google Scholar, Google (see appendix 3), and World Cancer Research Fund International's NOURISHING policy database to identify relevant reports.

Screening

Due to the rapid nature of the reviews, a single reviewer screened titles and abstracts and discussed any uncertainty with a second reviewer. For relevant titles/abstracts, the full text was retrieved for full text review. One reviewer reviewed full texts and discussed uncertainties with the project lead (who is an expert in evidence synthesis and obesity research).

Assessment of methodological quality

All relevant reviews were critically appraised by two reviewers individually using the JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses. We selected the highest quality and up-to-date review for data extraction.

Article selection

If the search identified more than one review that included meta-analysis with a pooled effect size, we selected the single review that best represented our research question. If there was equal suitability to the research question across the reviews, we then made a selection based on the JBI quality rating, taking the year of publication into consideration (with more up-to-date reviews being seen as more favourable due to the probable inclusion of more studies). If the search did not identify any reviews that included a meta-analysis/pooled effect size, we did one of the following:

- used a published evaluation of a policy reported on the NOURISHING database
- used an Impact Assessment that had been published by a UK (or devolved) government that had been conducted in partnership with an academic institution
- used the highest quality evidence from individual studies reported in a narrative synthesis.

We made the decision based on what we considered to be the most appropriate and robust evidence to answer the research question.

Data extraction

The JBI Data Extraction Form for Review for Systematic Reviews and Research Syntheses was used for data extraction for the final included review. Extracted characteristics included:

- Review characteristics: author/year, objectives, participants (characteristics, total number), setting/context, interventions of interest, date range of included studies, detailed description of the included studies (number/ type/ country of origin of included studies), appraisal instrument and rating, type of review/method of analyses and outcomes.
- Results: findings of the review and comments.

Results

One systematic review, Cohen et al. (2021) was identified. Although this review reported BMI reductions associated with universal free school meals in some studies, the review was deemed unsuitable as only one of seven of these studies was from a UK context. Due to the highly country-specific nature of packed lunches and school meals, we decided to progress our search to individual studies carried out in a UK context.

From this search, three reports/papers were identified: Holford and Rabe (2022a), Holford and Rabe (2022b), and Kitchen et al. (2012). After evaluating methods used in these studies we decided to exclude Kitchen et al. (2012) due to the following issues with the report:

- the methods used and their rationale are unclear
- for a robust analysis, we would have expected a before and after analysis of changes in levels of BMI, however, this is not what is reported.

Therefore, this report is based on the findings of two studies: Holford and Rabe (2022a) and Holford and Rabe (2022b). Holford and Rabe (2022a) analyses the effect of the rollout of universal infant school meals across England and Holford and Rabe (2022b) analyses the effect of universal free school meals in rollout in primary schools in multiple LAs.

Universal infant school meals (Holford and Rabe, 2022a)

The study evaluated the effects of the universal infant free school meal (UIFSM) policy, which was implemented in England from September 2014, on children's body weight outcomes. It also examined whether the effects vary by socio-economic status, gender, and ethnicity. The research also explored the mechanisms through which the policy may have affected body weight outcomes, such as changes in diet, physical activity, and stigma associated with receiving free school meals.

Data and methods

Data came from the National Child Measurement Programme (NCMP). To evaluate the programme, the researchers exploited the timing of measurement in the NCMP throughout the school year, assuming that the impact of the programme depends on the 'dose' of free meals received, with a greater effect observed for children at the end of the first year in school than those just starting. The authors use a 'difference-in-difference' type model to estimate the effect as follows:

$$\bar{Y}_{st} = \beta_1 + \sum_{h=2}^{6} \beta_h HTERM_{hst} + \tau_u UIFSM_t + \sum_{h=2}^{6} \tau_h (HTERM_{hst} \times UIFSM_t) + \gamma X_{st} + \mu_s + \varepsilon_{st}$$

where $\overline{Y}_{st}$ is the mean of the outcome recorded in school s in year t, $HTERM_{hst}$ is a dummy for the NCMP visit to school s in school year t taking place in half-term h (numbered 1 to 6), $UIFSM_t$ is a dummy variable that switches on for the UIFSM policy years, X_{st} is a vector of controls that varies across school and time, μ_s is a school fixed-effect, and ε_{st} a normally distributed error term.

In this setup, β_h captures the effect of being exposed to the school environment up to half-term h, relative to half-term 1. The effect of UIFSM on body weight outcomes recorded in half-term 1 is captured by τ_u, and the effect of UIFSM for subsequent half-term blocks in this equation is given by $\tau_u + \tau_h$. The effect of the duration of exposure to UIFSM is captured by the interaction term coefficient τ_h. These are

intention-to-treat effects as not all students take up school meals. The authors estimate the equation above using linear models on our school-level data.

The authors include in X_{st} a comprehensive set of controls. Firstly, the authors control for other policies introduced during the observation period that may have had an effect on body weight outcomes. These include Department for Education pilot schemes for universal or extended means-tested entitlement to free school meals, and a number of other pilots run at the initiative of Local Education Authorities (LEAs) over the years preceding UIFSM. The authors characterise these using six dummy variable categories and also interact them with half-term blocks.

What did the study find?

The key findings of this study related to body weight are as follows, by the end of the school year after the rollout of UIFSM:

- The likelihood of having a healthy weight increased by 1.1 percentage points from a pre-policy average of 76%.
- The likelihood of obesity decreased by 0.7 percentage points from a pre-policy average of 9.4%.
- The BMI z-score was 4.1% of a standard deviation lower, corresponding to an absolute weight change of 63g for boys and 73g for girls.

Other findings include:

- Take-up among not eligible children increased by about 55 percentage points from just over 30% to around 85% after the rollout of UIFSM.
- Take-up among eligible children rose by around 3 percentage points, from 84% to 87%, following the rollout of UIFSM.
- The introduction of UIFSM reduced both supermarket expenditure and expenditure for eating out across all families. However, splitting the sample into families that would already have been eligible for free school meals and those that would not, the monthly savings are statistically significant for not previously eligible families only. In a household of two adults and two children that is not eligible for free school meals, having an additional child exposed to UIFSM reduces total household supermarket shopping expenditure by £13.03 and eating out expenditure by £6.35 over four weeks.

Methods for converting weight loss to kilocalories

Table 1: Characteristics of Holford and Rabe (2022a)

Total sample size	Country (Number of studies)	Age range
154,169	England	Policy effects ages 4 to 7. However, each outcome is measured for the following age groups: • Body weight outcomes: ages 4 to 5 • Take-up: ages 4 to 7 • Expenditure: households with children ages 4 to 7

Universal free school meals (Holford and Rabe, 2022b)

Holford and Rabe (2022b) investigated the impact of universal free school meals (UFSM) for primary school children on child obesity and household food expenditure in England. They do this by investigating the impact of the rollout of UFSM in four LAs: Newham (from 2010), Islington (from 2011), Southwark (from 2012) and Tower Hamlets (from 2014). Note that this study investigates UFSM as opposed to Universal *Infant* Free School Meals as in Holford and Rabe (2022a) described above.

Data and methods

For body weight outcomes, data came from school-level data from the NCMP. These data are collected by trained nurses visiting schools to weigh and measure all Reception (aged 4-5) and Year 6 (aged 10-11) children whose parents have not opted them out of the study.

The authors used difference-in-difference methods to estimate the effect of the rollout of UFSM on childhood obesity in four London boroughs. Their analysis controls for the presence of a universal school breakfast scheme, the timing of measurement (academic year and half-term within each year), and interactions of this timing with the proportion of children measured who are girls or of Black ethnicity, the school's quintile of the Income Deprivation Affecting Children Index, and a School Fixed

Effect. They compare schools in treated areas with the rest of England, weighted to have the same profile in terms of observable characteristics.

What did the study find?

The key findings of this study related to body weight are as follows, the rollout of UFSM was associated with:

- Receiving UFSMs reduces prevalence of obesity by 9.3% among Reception children and 5.6% among Year 6 children on average.
- 1.3 to 1.4 percentage point reduction in obesity from a baseline of 14% in Reception.
- 1.3 to 1.4 percentage point reduction in obesity from a baseline of 25% in Year 6.
- The impact on children being overweight or obese is smaller and cannot be statistically distinguished from zero. The larger effects at the threshold of obesity rather than overweight suggest that more of the impact is on children towards the top of the body weight distribution.

Some other findings include:

- Effects are largest among Year 6 children who received UFSM the longest: the reduction in obesity was 8.4% among children who received them throughout primary school (2.1 percentage points reduction).
- The effect on children receiving UFSM for the first time in Year 6 is smaller than the corresponding effect on Reception children. This indicates that the body weights of older children are harder to shift in the short term.
- The impact of UFSM is much smaller in schools with pre-existing high prevalence of obesity.
- No discernible pattern of differences in UFSM impact between richer and poorer schools.

Appendices

Appendix 1: PubMed search strategy

No.	Concept	PubMed search terms
1	School meals	school [tiab] AND (meal [tiab] OR dinner [tiab] OR food [tiab])
2	Calorie intake	"Energy Intake" [Mesh] OR "Calorie consumption" [tiab] OR Calori* [tiab] OR "Calories consumed" [tiab] OR "Calorie intake" [tiab] OR "Caloric intake" [tiab] OR "Energy" [tiab] OR "Energy Intake" [tiab] OR "Food consum*" [tiab] OR kcal [tiab] OR kj [tiab]
3	Weight and obesity outcomes	"Obesity"[Mesh] OR "obesity"[tiab] OR "overweight"[tiab] OR "over-weight"[tiab] OR "Weight" [tiab] OR BMI OR "body composition"
4	Systematic review	"systematic*"[tiab] OR "meta-analys*"[tiab] OR "narrative synthes*"[tiab]
5	Full search	#1 AND (#2 OR #3) AND #4

Appendix 2: Cochrane Database search

"School meals calorie obesity"

Appendix 3: Google Search and Scholar

"effect of free school meals on calorie consumption and obesity"