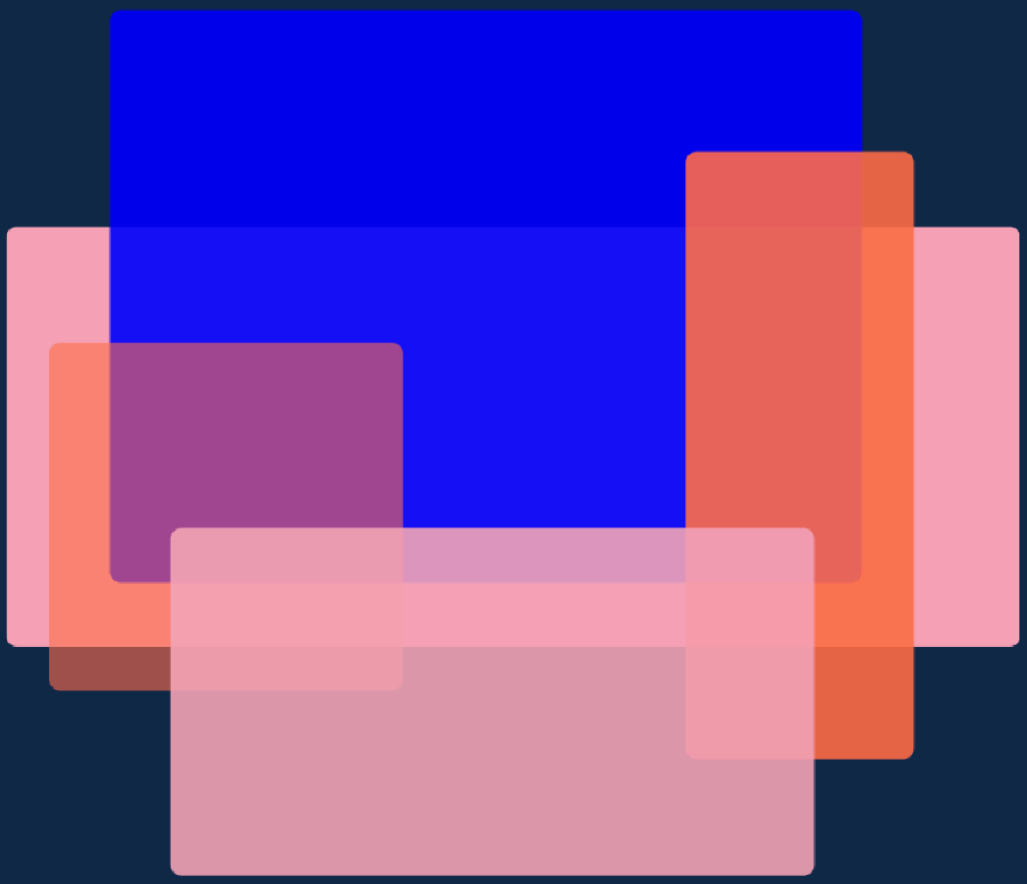
Blueprint
by nesta

Blueprint for halving obesity: rapid review

Advertising and food and drink intake



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Summary table

Title	Advertising as a cue to consume: A systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults	The effect of screen advertising on children's dietary intake: A systematic review and meta-analysis	Changes in household food and drink purchases following restrictions on the advertisement of high fat, salt, and sugar products across the Transport for London network: A controlled interrupted time series analysis
Author and year	Boyland et al. (2016)	Russell et al. (2019)	Yau et al. (2022)
Type of study	Systematic review and meta-analysis	Systematic review and meta-analysis	Interrupted time series analysis
Outcome variable	Mean difference in food intake in ounces, grams, kilocalories, kilojoules, or number of items eaten	Mean difference in energy consumed (in kcal) during or directly after exposure to advertising/advergames	Average weekly household energy purchased from HFSS products

Treatment	Exposure to unhealthy food advertising	Exposure to food screen advertising	Transport for London (TfL) outdoor HFSS advertising ban
Control	No exposure	Nonfood screen advert exposure	No exposure
Magnitude of effect (Adults)	0	Not in scope of the meta-analysis	1,001kcal reduction in average weekly household purchase of energy from HFSS products or 59.6kcal reduction in average daily kcal purchase per person
Magnitude of effect (Children)	Standardised mean difference in consumption = .56	57.7kcal	Not in scope
Notes	For modelling the impact of this policy, all the reviews were used (as highlighted in green).		

Rapid umbrella review

Background

The restriction of advertising of unhealthy foods is a commonly proposed policy designed to reduce consumption of unhealthy food and drink. Examples where it has been implemented include TfL's restrictions of the advertising of HFSS food and drinks and Barnsley's restrictions on HFSS advertising on council-owned sites. The UK Government has delayed plans for a ban on the advertising of HFSS food and drink online and on TV between 05:00 and 21:00, until 2025.

Objective

To summarise the best available evidence on the impact of advertising on calorie consumption/purchasing.

Methods

We aimed to identify and synthesise reviews that included quantitative research synthesis of the effectiveness of advertising restrictions of unhealthy food and drink on outcomes relevant to calorie consumption, weight loss, or obesity. 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 to 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 advertising restriction of unhealthy food and drink on outcomes relevant to calorie consumption, weight loss, or obesity outcomes.

If the search didn't identify any studies where a meta-analysis had been conducted due to heterogeneity of outcomes, we included reviews with narrative synthesis. We did not set inclusion criteria on the number or type of databases searched. We selected a single review (or reviews) that best represented our research question.

Participants. To be eligible, articles were required to examine the effect of advertising restriction of unhealthy food and drink on outcomes relevant to calorie consumption, weight loss, or obesity. If there were no reviews aimed specifically at children and specifically at adults, we selected one review for each.

Intervention. We defined the intervention as a restriction of, or exposure to, the advertising of unhealthy foods. We intended to include two types of interventions in the review. Lab studies where participants were exposed to advertising of unhealthy foods and quasi-experimental studies that measured the effect of a real-world restriction of unhealthy food and drink advertising. We took a broad approach to the definition of unhealthy food and drink which included high calorie, HFSS, and ultra-processed food and drink.

Comparator. The comparator for lab studies was participants who are not exposed to the advertising of unhealthy food and drink. The comparator for quasi-experimental studies would have been individuals who are not affected by unhealthy food and drink advertising restrictions or individuals who are affected by unhealthy food and drink advertising before the restriction began.

Outcomes. To be eligible for inclusion, reviews must have included either clinical (eg, weight, BMI, % fat change) or behavioural outcomes (including, but not limited to: eating behaviour, reported consumption in food diaries). Reviews that only included measures of intentions/plans for future behaviour were excluded due to evidence of the gap between intended and actual eating behaviour.

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 as well as via MEDLINE using the MeSH function. A search was performed in MEDLINE and the Cochrane Database of Systematic Reviews. We searched grey literature using

Google Scholar and Google to identify relevant reports. The search was run in January 2023.

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 the full texts and discussed uncertainties with a second reviewer.

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 reviews for data extraction. Suitability to our research question was also taken into account when selecting the final reviews for extraction.

Data extraction

The JBI Data Extraction Form for Review for Systematic Reviews and Research Syntheses was used for data extraction for the final included reviews. 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), appraisal instrument and rating, type of review/method of analyses and outcomes.
- Results: findings of the review and comments.

Results

This report is based on the findings of three reviews – two on screen advertising and one on public transport advertising.

Relating to screen advertising were Boyland et al. (2016) and Russell et al. (2019). Only reviews of the effect of screen advertising on immediate calorie consumption

were found. We were unable to find reviews of quasi-experimental evaluations of advertising restrictions. We take results for adults from Boyland et al. (2016) and children from Russell et al. (2019).

A more recent systematic review by Arrona-Cardoza et al. (2022) was identified, however this was not the chosen review due to restricting the review to papers published after 2014, and therefore it had reviewed fewer individual studies than the chosen reviews. This is a slight deviation from the protocol due to the unique nature of the very recent cut-off.

Relating to public transport advertising was a paper by Yau et al. (2022).

A. Screen advertising and calorie intake for adults (Boyland et al., 2016)

Boyland et al. (2016) conducted a meta-analysis of experimental studies investigating the impact of unhealthy food screen advertising exposure and food intake. Their study included studies of children and adults. However, a more recent review (Russell et al., 2019) was written on studies including child participants, so Russell et al. (2019) is used for children and adolescents and Boyland et al. (2016) is used for studies with adults.

What studies did the review include?

The review included articles if they reported studies that:

- manipulated acute advertising exposure (including at least one condition in which participants were exposed to unhealthy food or nonalcoholic beverage advertising on television or the internet and another condition with a nonfood advertisement or a no-advertisement control)
- formally measured food or nonalcoholic beverage intake, which was assessed as either energy intake or the quantity of item consumed
- used experimental designs, including both within-subjects/ repeated-measures and between-subjects/independent-groups.

We rated the review methods as being at low risk of bias.

What were the systematic review methods?

Statistical analysis: The team calculated the standardised mean difference (SMD) and the standard error (SE) of the SMD between food intakes of the experimental (food advertising) and control conditions in each study. They formally assessed the effect of advertising exposure with the use of a generic inverse variance meta-analysis that was conducted in Review Manager software [RevMan version 5.3.5].

What did the review find?

The following is a non-exhaustive summary of the results from Boyland et al. (2016). See the original article for full results. The review identified seven studies with adults only, with a total sample size of 498.

For the seven experiments that included adult participants only, there was no evidence of an effect of food advertisement exposure on food intake (SMD: 0.00; p=1.00; 95% CI: 20.08, 0.08; I^2 = 8%). All studies included in this study of adults were of television adverts.

It should be noted however, the more recent review Arrona-Cardoza et al. (2022) found a small, but significant effect of food advertising exposure on food intake (SMD: 0.16; 95% CI: 0.03, 0.28). However, this review was not used due to reasons outlined above.

Table 1: Characteristics of Boyland et al. (2016) adult subsample meta-analysis

Total number of studies	Total sample size	Country (number of studies)	Age range	Sample size range	Mean TV advertising exposure time	Mean advergame advertising exposure time	Total number of TV studies	Total number of advergame studies
7	498	Not reported	18+	19 to 47	Not reported	No studies	7	0

Table 2: Results from Boyland et al. (2016) adult subsample meta-analysis

Sample/subsample	Studies, N	Intervention arms, N	Standard mean difference in calorie intake between intervention and control groups
Adults	7	7	0.00 (95% CI: -0.08-0.08)

B. Screen advertising and calorie intake for children (Russell et al., 2019)

Russell et al. (2019) is the chosen meta-analysis for the impact of screen advertising on children's food intake.

What studies did the review include?

- Studies were required to compare the effect of food screen advert exposure with nonfood screen advert exposure.
- Outcome must be in calories or a measure convertible to calories.
- Experimental studies only for the relevant part of the study.
    - Non-experimental studies were included in a separate analysis but were not meta-analysed and, therefore, not included in Blueprint.
- Data from substudies were not included where interventions/preloads were administered (eg, 'protective messages'/glucose drinks). Outcome food groups were also combined to give total dietary intake. Within- and between-subject studies were also combined in meta-analyses.
- All adverts were for low-nutrient/energy-dense products; however, brands and products advertised varied, as did the advert break and total advert duration. Data for a 'light' food (low energy) advert condition were excluded; data for branded and unbranded food adverts were combined; data from a control condition where a celebrity endorser was shown in a nonfood context were excluded; and data for healthy food adverts were excluded.
- Data from healthy food adverts and no advergame control data were excluded; data for advergames with food adverts/nonfood adverts with a protective message intervention were excluded.
- Data for combined media (the effect of TV adverts with advergame) were excluded since the effect was inconsistent for TV or advergame analyses.

We rated the review methods as being at low risk of bias.

What were the systematic review methods?

Statistical analysis: Heterogeneity was determined using the I^2 statistic. Owing to study design and measure inconsistency, the DerSimonian-Laird random effects model was used for meta-analysis for experimental studies. Separate meta-analyses were conducted for TV and advergame interventions. Within- and between-subject studies were combined, and sensitivity analyses were conducted to assess the impact on overall effect size. For the main analyses and where possible, groups were combined to give an overall comparison for each study; age, sex, BMI groups, and groups by child characteristics (eg, level of inhibition). Data from substudies were not included where interventions/preloads were administered (eg, 'protective messages'/glucose drinks). Outcome food groups were also combined to give total dietary intake. Within- and between-subject studies were also combined in meta-analyses. Where required and appropriate, the Satterthwaite approximation was used to combine standard error values for two groups. Studies with more than two relevant groups were included as separate data points (two studies).

What did the review find?

The following is a non-exhaustive summary of the results from Russell et al. (2019). See the original article for full results. The review identified 16 articles, which had a total of 19 studies, with child participants, with a total sample size of 1,681.

Table 3: Characteristics of the review Russell et al. (2019)

Total number of studies	Total sample size	Country (number of studies)	Age range	Sample size range	Mean TV advertising exposure time	Mean advergame advertising exposure time	Total number of TV studies	Total number of advergame studies
16	1,681	United States (n=7), the Netherlands (n=7), the United Kingdom (n=5), Australia (n=2), Canada (n=2), Spain (n=1), Georgia (n=1), and Mexico (n=1); one study contained separate samples in Spain and the Netherlands	2 to 18 Mean (TV studies): 9.2 Mean (advergame studies): 8.7	19 to 100	TV viewing time: 20.1 minutes Advertising viewing time: 4.4 minutes	Duration of playing advergame: 5 minutes	11	5

Meta-analysis revealed that for television and advergames combined, food advertising, compared with nonfood advertising increased dietary intake among children/adolescents in experimental conditions; mean difference 57.7kcal ($p<0.01$; 95% CI: 36.61-78.75; $I^2 = 99.7$). The effect size point estimate for television food advertising was 60.0kcal ($p<0.05$; 95% CI: 3.06-116.94; $I^2 = 99.76$). Funnel plots showed some evidence of asymmetry and trim and fill analysis showed evidence of one missing study. Eggers regression analysis revealed low risk of publication bias ($p=0.696$). The average time children were exposed to television advertising (data available in n=8 studies) was 4.4 minutes (range 45 seconds to 8 minutes); however, there was no association between length of advert exposure and effect size (n=9, r=0.056, $p\geq0.05$). The effect size point estimate for advergames was 53.2kcal ($p<0.001$; 95% CI: 31.49-74.85; $I^2 = 99.71$); the mean duration of advergames was five minutes, but it was not considered reasonable to calculate an exposure duration/effect size relationship.

Eating duration period was found to be a significant predictor of effect size; studies that gave children 15 minutes or less to eat during and/or post advertising exposure reported significantly lower effect sizes (n=19, coef=1.50, SE=0.69, CI: 0.04-2.97, $I^2 = 99.69$, R2 = 17.17%).

Table 4: Results of meta-analysis for adults

Sample/subsample	Studies, N	Intervention arms, N	Difference in calorie intake between intervention and control groups
Full sample	19	19	57.7kcal (95% CI: 31.49-74.85) less in the intervention group
TV advertising	12	12	60.0kcal (95% CI: 3.06-116.94) less in the intervention group
Advergame advertising	7	7	53.2kcal (95% CI: 31.49-74.85)
Healthy weight	4	4	79.9kcal (95% CI: 19.89-179.66)
Overweight and obese	4	4	125.5kcal (95% CI: 18.80-232.25)

C. TfL's HFSS advertising ban (Yau et al., 2022)

Yau et al. (2022) evaluated the impact of HFSS advertising restrictions, implemented across the London (UK) transport network in February 2019, on HFSS purchases. See the original article for full results.

What statistical analysis methods did they use?

Utilising a Controlled Interrupted Time Series (CITS) analysis design, the researchers calculated the average weekly household acquisitions of energy and nutrients derived from HFSS products, as well as the purchases of HFSS product packages in post-intervention London. This assessment was juxtaposed with a counterfactual scenario representing the absence of the intervention. The study scrutinised the acquisition patterns of all items categorised as HFSS, focusing specifically on five key HFSS categories: (1) chocolate and confectionery, (2) puddings and biscuits, (3) sugary drinks, (4) sugary cereals, and (5) savoury snacks.

What did the review find?

The analysis encompassed 1,970 households, comprising 977 households in London (intervention group) and 993 households in the North of England (control group). The two groups, intervention, and control, exhibited similarities in household characteristics. However, there were slight variations in the characteristics of the main food shoppers, specifically in terms of gender (71.6% vs 74.3% female), socioeconomic position (27.5% vs 19.6% high socioeconomic position), and BMI (44.9% vs 53.1% overweight/obese).

The implementation of HFSS advertising restrictions was associated with a relative reduction in average weekly household energy purchased from HFSS products of 1,001.0 kcal (95% CI: 456.0-1,546.0), or 6.7% (95% CI: 3.2%-10.1%), in the intervention group compared to the counterfactual