

# How effective are interventions at reducing socioeconomic inequalities in obesity among children and adults? Two systematic reviews

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## Scientific summary

Effectiveness of interventions at reducing inequalities in obesity

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# Scientific summary

## Background

There is growing evidence of the impact of overweight and obesity on short- and long-term functioning, health and well-being. Obesity is causally linked to chronic diseases such as diabetes, coronary heart disease, stroke, hypertension, osteoarthritis and certain forms of cancer. It is predicted that, as the UK population grows and ages, the burden of diseases associated with obesity will cost the NHS £10B per year by 2050 and will result in escalating numbers of early deaths as well as long-term incapacity and associated reductions in quality of life. Tackling obesity is therefore rightly highlighted as one of the major contemporary public health policy challenges and is vital in terms of addressing health inequalities. However, there is a lack of accessible policy-ready systematic review evidence on what works in terms of interventions to reduce inequalities in obesity. We conducted two systematic reviews to address this deficit in the knowledge base by reviewing primary studies of the effectiveness of interventions to reduce socioeconomic status (SES) inequalities in obesity in a whole-systems way. This is because the aetiology of obesity is complex – it is the outcome of important structural drivers in the food system (such as upsizing to increase sales; use of extracted fat; replacement of fat by sugar; marketing directed at children through the education system and social media) and in the contemporary organisation of society (e.g. 'labour-saving' devices; cities designed for cars; long working hours; lack of green space). The reviews therefore examine public health interventions at the individual, community and societal levels. They also examine the organisation, implementation and delivery of such interventions.

## Objectives

1. To systematically review the effectiveness of interventions (individual, community and societal) in reducing socioeconomic inequalities in obesity among children.
2. To systematically review the effectiveness of interventions (individual, community and societal) in reducing socioeconomic inequalities in obesity among adults.
3. To establish how such public health interventions are organised, implemented and delivered.

## Review methods

We conducted reviews on the effectiveness of interventions in reducing obesity among (1) children and (2) adults. The reviews were carried out following established criteria for the good conduct and reporting of systematic reviews.

## Interventions

The reviews examined interventions at the individual, community and societal levels that might reduce inequalities in obesity among children aged 0–18 years (including prenatal) and adults aged >18 years, in any setting, in any country. The reviews considered strategies that might reduce existing inequalities in the prevalence of obesity (i.e. effective targeted interventions or universal interventions that work more effectively in low-SES groups), as well as those interventions that might prevent the development of inequalities in obesity (i.e. universal interventions that work equally along the SES gradient). Interventions that involved drugs or surgery, and laboratory-based studies, were excluded from the reviews.

### Study designs

We included experimental studies, defined as randomised and non-randomised controlled trials and observational studies including prospective and retrospective cohort studies (before-and-after studies), with or without control groups, and prospective repeat cross-sectional studies with or without control groups. Only studies with a duration of at least 12 weeks (combination of intervention and follow-up) were included.

### Search strategy

The following nine electronic databases were searched from their start date to 10 October 2011 (child review) or 11 October 2012 (adult review) (host sites given in parentheses): MEDLINE (Ovid), EMBASE (Ovid), Cumulative Index to Nursing and Allied Health Literature (NHS Evidence Health Information Resources), PsycINFO (NHS Evidence Health Information Resources), Social Science Citation Index (Web of Science), Applied Social Sciences Index and Abstracts [Cambridge Scientific Abstracts (CSA)], International Bibliography of the Social Sciences (EBSCOhost), Sociological Abstracts (CSA) and the NHS Economic Evaluation Database [NHS Centre for Reviews and Dissemination (CRD)]. We did not exclude papers on the basis of language, country or publication date. The electronic database searches were supplemented with website and grey literature searches.

### Outcomes

In terms of outcomes, studies were included only if they included a primary outcome that is a proxy for body fat (weight and height, body mass index (BMI), waist measurement/waist to hip proportion, percentage fat content, skinfold thickness, ponderal index in relation to childhood obesity). Data on related secondary outcomes were also extracted. Studies were included only if they examined differential effects with regard to SES or were targeted specifically at disadvantaged groups or were conducted in deprived areas. Data on the organisation, implementation and delivery of interventions were also obtained.

### Data extraction and quality appraisal

The initial screening of titles and abstracts was conducted by one reviewer, with a random 10% of the sample checked by a second reviewer. Data extraction was conducted by one reviewer using established data extraction forms and independently checked by a second reviewer. The methodological quality of the included studies was appraised independently by two reviewers using the Cochrane Public Health Review Group-recommended Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies. Any discrepancies were resolved through discussion between the authors and, if consensus was not reached, with the project lead.

### Analysis and synthesis

Because of the heterogeneity of the studies, it was possible to use meta-analysis only for a minority of the included studies. When meta-analysis was not possible, narrative synthesis was conducted focusing on the 'best-available' evidence for each intervention type (defined in terms of study design and quality).

## Results

### Child review

#### Individual

In total, we located 11 studies (13 papers) of individual-level interventions. The 'best-available' international evidence comes from four moderate- or high-quality experimental studies and suggests that studies of tailored weight loss programmes work equally well across the SES gradient and can have even more beneficial effects in the lower-SES groups; screen time-reduction interventions can have beneficial effects in low-SES children but not in high-SES children, both in the short term and in the long term; and mentor-based health promotion interventions can have beneficial long-term effects among disadvantaged children who are most at risk (overweight and obese). This evidence suggests that interventions of this

type may help reduce SES inequalities in obesity. There were no studies that assessed the cost-effectiveness of interventions.

The UK evidence comes from one low-quality observational study of a primary care educational and behavioural weight loss programme, which found positive results in terms of BMI reductions that were equally distributed across the SES gradient.

### Community

In total, we located 52 (54 papers) studies of community-level interventions. The 'best-available' international evidence comes from 13 high-quality experimental studies which suggest that school-based nutrition and physical activity education combined with exercise sessions can be effective in low-SES school-aged children and when delivered universally to children of all SES groups after reasonably long follow-up times ( $\geq 6$  months), but may not be effective in preschool-aged children in the short term. School-based education-only interventions are not so consistently effective in low-SES children, and school-based screen time-reduction interventions can be equally effective across the SES gradient after 6 months. Family-based education and behavioural group weight loss programmes can be beneficial in terms of short-term weight loss and long-term weight maintenance and work equally across the social class gradient. Group-based exercise-only weight loss programmes may result in short-term weight loss among low-SES school-aged children. Group-based weight gain prevention educational interventions have no effect in low-SES preschool and school-aged children. There were no studies that assessed the cost-effectiveness of interventions.

The UK evidence comes from one low-quality observational study of a community-based counselling weight loss programme that found no effect initially but BMI reductions in low-SES children in the longer term (6 months).

### Societal

In total, we located 10 studies (15 papers) of societal (environmental)-level interventions but no studies of societal (macro)-level interventions. The 'best-available' international evidence for the environmental interventions comes from five moderate-quality experimental studies and suggests that multifaceted school-based obesity prevention interventions are effective at reducing or preventing increases in obesity-related outcomes in low-SES children aged 6–12 years but may not be effective among low-SES preschool children.

There were no UK studies of societal-level interventions.

### Individual-, community- and societal-level studies

In total, we located three studies (three papers) of multilevel interventions that spanned each of the individual, community and societal levels described in our framework. The 'best-available' international evidence comes from one high-quality experimental study which found that a community capacity-building intervention halted the widening of inequalities in obesity that was observed in the control community.

There were no UK studies of multilevel interventions.

## Adult review

### Individual

In total, we located 33 studies (31 papers) of individual-level interventions. The 'best-available' international evidence, from five high-quality experimental studies, suggests that primary care-delivered tailored weight loss programmes targeted at low-income groups can have positive short-term effects on weight outcomes (up to 9 months) but that these are not sustained in the longer term (after 12 months). Health education interventions have little long-term impact on weight outcomes in high- or low-income groups. These individual-level interventions therefore seem only to provide short-term reductions in

obesity-related outcomes among low-SES groups. The impacts on SES inequalities in obesity are therefore likely to be very small and short-lived. There were no studies that assessed the cost-effectiveness of interventions.

The UK evidence comes from seven studies (two experimental and five observational) and suggests that tailored weight loss programmes delivered in primary care can have positive short- and long-term effects on obesity-related outcomes in low-SES groups, and are equally effective across the SES gradient.

### Community

In total, we located 60 studies (62 papers) of community-level interventions. The 'best-available' international evidence, from 12 high-quality experimental studies, suggests that community-based group weight loss interventions have short-term (3 months) but no longer-term positive effects on weight loss. Group-based lifestyle counselling-style interventions have limited effects, as do group-based health education interventions. Workplace studies suggest that longer-term positive effects on obesity-related outcomes require more complex, multifaceted interventions. School-based physical activity and education interventions for adults have little effect. There were no studies that assessed the cost-effectiveness of interventions.

The UK evidence comes from four studies (one experimental and three observational) and suggests that group-based weight loss programmes (diet clubs, commercial and behavioural programmes) have positive effects in the short term in low-SES groups or equally across the SES gradient. However, these positive effects are not maintained in the long term.

### Societal

In total, we located eight studies (eight papers) of societal (environmental)-level interventions and two studies (two papers) of societal(macro)-level interventions. The 'best-available' international evidence for the environmental interventions comes from one moderate-quality experimental study and two weak observational studies. The experimental study took a universal approach and examined an intervention that modified the work environment. It suggested that a multifaceted workplace weight prevention intervention could actually increase SES inequalities in obesity-related outcomes. The two low-quality observational studies took a targeted approach and examined effects of the US food stamp programme. Together, the studies found little evidence of a relationship between participation and weight change. There were no studies that assessed the cost-effectiveness of interventions.

The UK evidence base consists of one low-quality observational study of a multifaceted cardiovascular disease prevention programme (including food labelling, increased availability of healthy food choices and a worksite health promotion programme). There were no intervention effects on the prevalence of overweight and there were no differential effects by SES.

### Limitations

We located few evaluations of societal-level interventions and this was probably because we did not include non-experimental study designs. Although described as a tool for public health interventions, the quality appraisal tool seemed to favour those that followed a more clinical model. We particularly found the blinding question unhelpful as it mostly resulted in moderate scores. The implementation tool was practical but enabled only a brief summary of implementation factors to be made. The theoretical framework adapted from the health inequalities literature meant that most studies were categorised as community-level interventions and we encountered difficulties in determining in which section of the framework particular interventions should sit. Most of the studies synthesised in the reviews were from outside the UK and related to women. One final limitation that may be of particular relevance to the non-UK evidence base is our exclusion of studies that examined ethnic inequalities, which may have reduced the US literature in which ethnicity is often used as a proxy for SES.

## Conclusion

### *Summary of results*

We located 76 studies of inequalities in obesity in children and 103 in adults. This evidence suggested that individual-, community-, societal- and multilevel interventions that aim to prevent, reduce or manage obesity do not increase inequalities; that some universal interventions reduced the gradient in obesity; and that many targeted interventions were effective in decreasing obesity among lower-SES groups. There was most evidence of effectiveness in reducing inequalities in obesity for targeted school-delivered interventions and environmental interventions. Multilevel interventions that use community empowerment mechanisms (collective/community control over the design and implementation of interventions), for example, may also be effective in reducing the widening of inequalities in obesity among children. For adults, targeted primary care-delivered tailored weight loss programmes and group weight loss interventions had the most evidence of potential effectiveness in reducing obesity, at least in the short term among low-income women. Only a minority of studies were experimental and there were only 14 UK studies; there were few evaluations of societal interventions and there were no studies that assessed cost-effectiveness.

### *Recommendations for research*

Our results show that there is a clear need for more experimental studies of the effectiveness and cost-effectiveness of interventions to reduce inequalities in obesity among children and adults (especially among men and adolescents), particularly in the UK, and especially in terms of macrolevel interventions that potentially address the entire gradient. The latter probably reflects a tendency among researchers, practitioners and funders to focus at this level when evaluating interventions, as the evaluation of complex interventions is difficult and often gives equivocal results. Few studies were found that evaluated more upstream interventions; this is not evidence of lack of effectiveness, rather a lack of evaluation evidence of this type of intervention.

Our results show that there is a clear need for more evaluations of the effects of interventions in reducing SES inequalities in child and adult obesity, particularly in terms of:

- priority 1: country context – the UK
- priority 2: population groups – adolescents and adult men
- priority 3: intervention types – macrolevel interventions that potentially address the entire gradient (such as taxes on high-fat foods or a ban on television advertising of fast foods) and multilevel interventions that, for example, use community empowerment mechanisms to reduce inequalities in obesity
- priority 4: study design – experimental studies of effectiveness and cost-effectiveness.

There is also a need to review the possibility of conducting secondary analysis of existing data sets (e.g. Healthy Towns, Change4Life) to assess if it is possible to retrospectively explore the effects on inequalities of these UK interventions that aim to manage obesity. We would also encourage all funders of such initiatives in the future to build a robust evaluation into such national programmes, or work alongside others who might conduct an evaluation (e.g. funded through the National Institute for Health Research Public Health Research programme). Research in this area is increasing rapidly in line with the increasing prevalence of obesity in developed countries and so regular updating of this review will be required.

### Implications for public health

In relation to which interventions could now be implemented by the UK public health community, our review has found tentative evidence of some interventions in children with the potential to reduce SES inequalities in obesity:

- School-based and environmental interventions targeted at low-SES children appear to have evidence of effectiveness – and over the longer term – in reducing obesity-related outcomes among low-income primary school-aged children. For example, the School Nutrition Policy Initiative (a 2-year multifaceted education and environment intervention in some low-income schools in the USA) increased nutritional knowledge and the availability of healthy food and reduced the prevalence of overweight by 35%.
- Multilevel interventions that, for example, use community empowerment mechanisms may also be effective in reducing the widening of inequalities in obesity among children. For example, the Australian Be Active Eat Well community capacity-building intervention was designed by a number of key organisations to build the community's capacity to create its own solutions to promoting healthy eating, physical activity and healthy weight and was delivered universally in all intervention schools. After 3 years, children in the intervention schools showed significantly lower increases in waist circumference and BMI.

Interventions of this type may therefore be worth commissioning in the UK by clinical commissioning groups or local authorities who wish to target services at low-income primary school children or children in deprived areas. However, these interventions should be piloted first and thoroughly evaluated using an experimental design.

Similarly, among adults, there is evidence that the following interventions targeted at individuals from low-income groups have some effectiveness – at least in the short term – in reducing SES inequalities in obesity, at least among low-income women internationally and in the UK:

- Primary care-delivered tailored weight loss programmes – there is evidence from UK and US studies that monthly face-to-face lifestyle counselling on healthy diet and physical activity behaviours, targeted at low-income women, can be effective in reducing body weight. For example, a UK study of a 12-week intervention found significant reductions in BMI, body weight and percentage body fat among overweight post-partum women living in areas of moderate to high deprivation.
- Community-based weight loss interventions (diet clubs, commercial and behavioural programmes) have positive effects in the short term in low-SES groups or equally across the SES gradient. For example, a behavioural therapy (e.g. problem-solving, assertion, stimulus control) and social support (peer delivered in groups) intervention was effective in reducing weight among low-income men and women in the USA.

These interventions may therefore be worth commissioning by clinical commissioning groups or local authorities who wish to target services at low-income women or at women in deprived areas. However, to be effective in the longer term, such interventions will need to be of a longer duration and supplemented with subsequent weight maintenance interventions. They may also need to be adapted to be effective among men.

### Study registration

The studies are registered as PROSPERO CRD42011001740 and CRD42013003612.

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