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`Tackling teenage obesity: literature review and project proposal`

**Desk research report for the
Barking and Dagenham Primary Care Trust,**

**as commissioned by
Jenny Boss,
Adolescent Obesity Co-ordinator**



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Executive summary

The problems of overweight and obesity in childhood and adolescence currently in England, East London and the boroughs of Barking & Dagenham (the latter being the geographical focus of this report) are prevalent and increasing. If not combated, they will increase very significantly over the coming years. The UK Department of Health wishes to reverse obesity levels by 2020 to year 2000 levels.

The consequences of adolescent obesity are various, implicating serious deficits in both mental and physical health domains both in the adolescent years and in later life, and ultimately it is a significant mortality risk-factor.

The causes of obesity in childhood and adolescence are multiple, with biological, genetic, life-cycle, behavioural social and environmental factors all being implicated.

Preventative and remedial strategies for intervening in childhood obesity have tended to focus on three elements: changing dietary behaviour; increasing physical activity; and decreasing sedentary behaviour. In many instances, the behavioural change tactics used to instigate these modifications have not been sufficiently multiple, despite a broad range being available.

Missing elements in such programmes include addressing the psychological functions of eating, the incorporation of knowledge about message framing and the formation of implementation intentions, the education of older adolescents about the dietary implications of alcohol consumption, the tailoring of interventions to take account of disaffected adolescents who are resistant to influence, tailoring of programmes for ethnic minorities, and exploiting what is known about reputation management amongst adolescents as a means of building in intrinsic social rewards to goal attainment.

An innovative remedial intervention programme needs to have multiple components, needs to be multi-level, needs to utilise and vigorously involve both school and family, need to address obesogenic environments, promote self-selection of participants into the programmes and employ long-term follow-up. In delivering its components, relevant combinations of twenty-six available behavioural change techniques should be used. The programme should employ a minimum of three intervention trajectories (including 'no intervention', or 'standard intervention') which can be compared with one another to evaluate their relative efficacy. These trajectories should be theory driven in their design and implementation so that mechanisms by which they work can be understood and elaborated. Such innovative intervention should seek to incorporate, build on and finesse initiatives articulated within the cross-government obesity strategy for England '*Healthy Weight, Healthy Lives*'.

1. Introduction

The aim of this report is to assess the available scientific literature which examines predictors of obesity in 11-18 years, with specific reference to the East London region, and in particular in relation to the boroughs of Barking and Dagenham (B&D). Through such examination this report thereafter aims to formulate a proposal for an intervention with this age-group in order to reduce the prevalence and incidence of obesity in teenagers.

Obesity can be conceptualised as the by-product of multiple distal and proximal causes, which are variously social, psychological and biological in nature. Proximal causes include eating behaviour, exercise behaviour, and metabolic anomalies. Distal causes include the gross demographic characteristics of socioeconomic and educational status. Obesity thereby is multifactorally caused. In the course of this review, the relative contributions of these factors will be examined, so that such antecedents can be targeted as part of a proposed prevention and remedial intervention strategy. Conditions that enable healthy eating and non-sedentary behaviour will be considered, as well as barriers to such.

2. Literature search strategy

A systematic literature survey was undertaken in order to identify publications relating to youth and adolescent obesity. Searches were conducted in the following areas: obesity prevalence and causes, social and psychological factors, consequences, prevention and intervention programmes. The target age group was eleven to eighteen. Relevant keywords were identified and these were combined with other terms or Boolean logic to widen the area or to make searches more precise. The keywords used in the search were as follows in the table overleaf (Table 1).

Keywords were used with modifiers in a number of combinations to create more complex expressions. The search focused on the following electronic databases available via the University's online resources: *EBSCO*, which gives access to bibliographic data and full text academic journal articles via *Academic Search Elite*, *PsycARTICLES*, *PsycINFO*, *CINAHL*, and *Pre-CINAHL*; further searches were conducted through academic databases including *Ingentaconnect*, *IBSS*, *Medline*, *PubMed*, and *ScienceDirect*. The years searched were from 2000 to 2008. Review papers were obtained from the *Cochrane Library*, *the Agency for Healthcare and Research Quality (AHRQ)*, and Annual Reviews. Academic journals were searched via these databases and also the *Directory of Open Access Journals (DOAJ)*. In addition, subject specific pre- and e-print archives were searched, including the *British Medical Journal*, *International Journal of Obesity*, *International Journal of Pediatric Obesity*, and *Obesity Management*.

Obesity	UK
Overweight	London
BMI	Barking & Dagenham
Self esteem	Mental health
Causes	Adolesc*
Consequences	Youth
Influence	Teenage
Culture	Beliefs
Race	Statistics
Social condition	Behavio*
Family	Activity
Sex difference	Characteristics
Prevention	Knowledge
Impact	Behav* Change
Deprived	Health outcomes
Social condition	Health* eating
Psychological	Attitude
Psychosocial	Belief
Psychometric	Assessment
Intervention	Body image
Risk factor	Mental
Motivation	intrinsic or extrinsic
Environment	Wellbeing
Evidence based	
Management	
Assessment	
Healthy Lifestyle	
Wellbeing	Physical or mental

Table 1: Keywords used in the literature search of databases

Specialist Websites were visited in order to obtain local and national information, population trends and statistics, from for example the *Department for Health, Health Survey* results, UK government published statistics, *National Health Service* publications, *Local Authority Newsletters*, the *RELACHS* study which investigated the health of young people in East London, the *HELENA Project* ('Healthy Lifestyle in Europe by Nutrition in Adolescence' - a European collaborative research project), and the *International Association for the Study of Obesity*.

3. The prevalence of teenage obesity

3.1. *Cautionary note*

Overall obesity is assessed by body mass index – weight-to-height ratio. However, central obesity, which has been found to be a more significant risk-factor for some major diseases, is measured by waist circumference. McCarthy, Ellis & Cole (2003) compared the results of representative cross-sectional surveys in Britain in 1977, 1987 and 1997 for 11-16 year olds and found that increases in waist circumference over that twenty year period greatly surpassed those in body mass index (BMI), with one being a poor indicator of the other. Thereby, they argue that the continued use of BMI significantly underestimates obesity prevalence in young people, yet data reported below and studies evaluated thereafter tend to rely on 'overall obesity' rather than central obesity as their key indicant.

3.2. *The picture in England*

In 2006, 16% of children aged 2 to 15 were obese. This represents an increase in obesity from 11% in 1995 (The Information Centre, National Health Service, 2008). Of 8 to 15 year olds who were obese, 66% of girls and 60% of boys thought they were too heavy. Zaninotto, Wardle, Stamatakis, Mindell & Head (2006) estimate that for children aged 2 to 15 that by 2010 19% of boys and 22 % of girls will be obese. A study of ethnic group differences in overweight and obese children and young people using data on 5689, 2-20 years olds from the 1999 Health Survey for England found that '*...British Afro-Caribbean and Pakistani girls have an increased risk of being obese and Indian and Pakistani boys have an increased risk of being overweight*', as compared with the general population (Saxeena, Ambler, Cole & Majeed, 2004). Their findings highlight the importance of examining the ethnicity and sex of respondents as variables in this context.

70% of boys and 59% of girls in 2006 participated in an hour or more of physical activity on all days in the previous week, whilst 30% of boys and 41% of girls did not do so (The Information Centre, National Health Service, 2008). 86% of pupils took part in a minimum of two hours of high quality PE and sport a week, while 14% did not. Men and women with low rather than high physical activity levels were twice as likely to have a raised waist circumference.

In 2006, 19% of boys and 22% of girls aged 5 to 15 ate five or more portions of fruit and vegetables a day, meaning that 81% of boys and 78% of girls did not do so.

3.3 *The picture in East London*

In 2003 the results of a major study of the health of young people in east London were published: the '*RELACHS 2001*' study – '*Research with East London Adolescents: Community Health Survey*' – was a cross-sectional, secondary school based study of 2790, 11-14 year old children in 28 schools across the three boroughs of Hackney, Newham & Tower Hamlets (Stansfeld et al, 2003; and subsequently Taylor et al, 2005). There were high levels of deprivation amongst the sample and the majority were from ethnic minorities. Findings for obesity indicate that the percentage of children in this sample who were classifiable as obese was '*...higher at all ages than the most recent national data in the U.K*'. Specifically, the study found that 24%

of 11-12 year old boys (year 7) and 16% of 13-14 year boys (year 9) were obese, while 23% of 11-12 year old girls and 21% of 13-14 year old girls were designable as such. It is notable these 2001 figures for East London exceed those for England in 2006, despite an increase nationally in obesity over that five year period. The report also notes that only 64% of boys and girls `...were not overweight or obese', implying that 36% were so.

Unfortunately the survey did not examine physical activity rates, however it did look at self-reported dietary behaviour. The RELACHS study found that half of its 11-14 year olds and 40% of its 13-14 year olds reported eating five or more portions of fruit and vegetables each day, thereby greatly exceeding those data found for 5-15 year olds in 2006 and as published by the NHS Information Centre (2008). The substantial differences between these studies in a direction that would not be hypothesised given other data, raises the possibility of the role of methodological artefacts in the production of these results. However, the RELACHS study did find that 28% of 11-12 year olds `never' or `hardly ever' ate breakfast, with only 50% of the boys and 39% of the girls in this year group eating breakfast every day.

These results from neighbouring boroughs that arguably share significant demographic characteristics with Barking and Dagenham, can thereby be extrapolated to these other East London areas.

3.4 *The picture in Barking & Dagenham*

Prevalence data for obesity for 11-18 year olds in the boroughs of Barking and Dagenham are not embedded within U.K. Department of Health statistics, nor are to be found in the NHS Barking & Dagenham Health Profile data for 2007. However, the Strategic Health Authority for London has published obesity prevalence data for 10-11 year olds for 2006/07 when it was 20.8%. The same strategic report required that by 2010/11 there be a reduction in obesity for that age-group of -1.9% (UK Department of Health, 2008). For Hackney the comparable figure was 24.4%, for Tower Hamlets 23% and Newham 23.6%. Prevalence rates for this age group for all areas in England varied in that year from 12.7% (Wokingham) to 27% (Southwark), with modal and median values in and around 16%. Thus, Barking & Dagenham's youth obesity problem is above average in terms of prevalence rates but is not as pronounced as some other East London boroughs.

4. The consequences of teenage obesity

In 2006, whilst 16% of 2-15 year old children were obese, 24% of adults (over 16 years of age) were classifiable as such, i.e. one quarter of the adult population, with men and women being equally likely of being obese. This compares with 15% in 1993. It is likely then that childhood obesity is a precursor to obesity in adulthood. Indeed, Whitaker, Wright and Pepe (1997) found that 55% of obese 6-9 year olds and 79% of obese 10-14 year olds are still obese in adulthood. With prevalence rates for obesity increasing in childhood, Zaninotto et al (2006) estimate that for adults aged sixteen or over by 2010, 33% of men and 28% of women will be obese. Whilst equivalent 2007 prevalence figures for B&D (23.4%) were not significantly different from the national average (21.8%), nearly a quarter of adults in these boroughs being obese is not acceptable from a public health perspective.

Obesity in early life has other adverse consequences, notably raising the likelihood of Type 2 diabetes, itself a risk-factor for other outcomes, such as coronary artery disease. Men over 35 years of age with a raised waist circumference are twice as likely to have Type 2 diabetes and such women are four times as likely (The Information Centre, National Health Service, 2008). The prevalence of diabetes also is increasing: in 2006 the number of prescriptions issued for pharmacological interventions for obesity was eight times as many as prescribed in 1999, an increase which cannot be attributable solely to a change in prescribing practices or to the availability of new, more efficacious pharmacological interventions. Like the prevalence of obesity in childhood, early death rates from heart disease and stroke in B&D, though declining over the last decade, remain above national averages and underscore the interdependence of these health problems. In these boroughs only 8.4% of adults were classifiable in 2007 as 'physically active' and 17% as engaging in 'healthy eating', both of these indices being below national averages. Such a pattern of poor diet, little exercise and being over-weight in part accounts for why the age-standardised mortality rates from early heart disease and stroke in B&D were 28 deaths per 100,000 greater than the national average (118 versus 90), as reported in the NHS Barking & Dagenham Health Profile (2007).

Childhood obesity is related to other outcomes. In a study conducted by Britz et al (2000) it was found that extremely obese adolescents go on to have high lifetime prevalence rates for affective, anxiety, somatoform and eating disorders, with, in most cases, these difficulties setting in after the onset of obesity. Miller & Downey (1999) found from a meta-analysis of relevant studies that lower self-esteem is related with heavier self-perceived weight, though Young-Hymn, Schlundt, Herman-Wenderoth & Bozylinski (2003) found that this relationship depends upon age, gender and '*...children's experiences with teasing and parental evaluation of their size*'. Datar & Sturm (2006) conclude that a move from not-overweight to overweight in the first four years of primary school is a '*...significant risk factor for adverse school outcomes among girls*' – amongst boys, such a progression was associated with an increase in absences from school.

Thus, the concomitants and consequences of overweight and obesity in childhood and adolescence are numerous, and very mostly undesirable and maladaptive in terms of both mental and physical well-being, obesity being a significant risk-factor for mortality and chronic health difficulties in adulthood.

5. The causes of teenage obesity

The causes of overweight and obesity in childhood and adolescence undoubtedly are multiple and cannot be reduced to one simple pre-eminent cause. Katzmarzyk et al (2008) reviewing the causes examines and implicates biology, genetics, life-cycle & transgenerational pathways, behavioural, social and environmental determinants, including the role of the family, the indirect role of the physical and built environment, and with particular focus upon physical activity deficits. Biological causal candidates include: '...low resting energy expenditure, low fat oxidation rate, low plasma leptin levels and low muscle oxidative potential'. In terms of genetics, Katzmarzyk et al (2008) note that while 22 genes have been implicated in obesity, individually they only explain small portions of variance. Life cycle risk factors include inadequate foetal nutrition and subsequent rapid weight gain following birth.

In terms of behaviour, the authors note the pervasive negative relationship amongst studies of adiposity in childhood and physical activity. They also note the 'direct relationship' between time spent watching television and obesity in most studies of obesity in children. In terms of social variables, parent support, support from significant others, sibling physical activity and direct help from parents have all been found to be significant determinants of physical activity levels in adolescents (Sallis, Prochaska & Taylor, 2000). Environmentally, lack of proximity to parkland, high crimes rates, lack of immediate outdoor space, lack of cycle-ways all mitigate against physical activity as part of daily living and thereby constitute barriers to weight maintenance or reduction.

Thus, the predisposition to develop obesity is a result of an interaction of multiple distal and proximal factors which collectively comprise a highly complex aetiological system. Though increasingly it is possible to change internal biological and genetic functioning through biochemical intervention, arguably it is more feasible to modify predispositions to obesity by seeking to bring about changes in behavioural, social and environmental domains.

6. Preventing & intervening in teenage obesity

This section of the report examines major reviews of obesity prevention and intervention research as published over the last eleven years, starting with the most recent first. From the search conducted, it is evident that since 1997, sixteen articles have been published worldwide which constitute substantive scientific reviews of issues relevant to the prevention and remediation of teenage obesity. Hereafter, key conclusions from these reviews are summarised and evaluated.

Five of these reviews were published in 2008, three of which are Cochrane Collaboration publications. The first of these by Summerbell, Waters, Edmunds, Kelly, Brown & Campbell (2008) reviews interventions for preventing obesity in children. Specifically, these interventions were either randomised control trials or controlled clinical trials with a minimum duration of twelve weeks. The majority of studies were short-term in nature. They concluded that *'studies that focused on combining dietary and physical activity approaches did not significantly improve body mass index'*, though those which focused on either did so modestly. Most of the interventions produce some positive benefit but not of a sufficient magnitude, leading the authors to recommend that duration and intensity of intervention needs to be considered carefully. The second of these Cochrane Collaborations reviewed psychological intervention for overweight or obesity (Shaw, O'Rourke, Del Mar & Kenardy (2008). The authors only examined studies that followed participants for at least three months and examined adults, limiting the relevance of this review here. However, noteworthy is the conclusion that a combination of either cognitive-behavioural or behaviour therapy with dietary and exercise interventions produced greater losses in weight than when any of these components were employed on their own. The results of this review therefore points up the value of multi-modal interventions. The third Cochrane review, by Pratt & Woolfenden (2008), sought to evaluate interventions for preventing eating disorders in children and adolescents. Despite identifying many articles, only a few met the selection criteria for methodologically adequate studies. The conclusions from this review are disappointing in that the authors were of the view that there was *'...insufficient evidence to support the effect of five programs designed to address eating attitudes and behaviours'*. These three reviews provide a mixed picture of the efficacy of interventions designed to target obesity or obesity-related variables, with two of them indicating poor levels of efficacy, whilst another indicating that no single modality intervention represents a treatment gold standard – the latter being consistent with the multifactorial aetiology of obesity.

The remaining two major reviews published in 2008 do not focus directly on obesity per se, but rather examine physical activity and fitness as allied antecedents. Van Sluijs, McMinn & Griffin (2008) in the *British Medical Journal* report a systematic review of controlled trials of interventions to promote physical activity in children and adolescents. They identified fifty-seven studies in all, twenty-four of which were of high methodological quality. In adolescents they found strong evidence that *'...school based interventions with involvement of the family or community and multicomponent interventions can increase physical activity in adolescents'*. Their conclusions concur with those of Shaw et al (2008) in terms of advocating a multi-modal approach. The other major relevant review of 2008, published in the *International Journal of Obesity* by Ortega, Ruiz, Castillo & Sjostrom, looks at the relationship between physical

fitness and health outcomes, underscoring amongst other things, that cardiorespiratory and muscular fitness *'...are shown to be associated with total and abdominal adiposity'*. Notwithstanding the possible bidirectional nature of this relationship, their review does emphasise the value of cardiovascular exercise as a part of a remedial intervention for obesity in adolescents. Echoing this recommendation, Brown, Kelly & Summerbell (2007), reviewing interventions for preventing obesity, note that school-based physical activity interventions in combination with reduced television viewing help children to maintain a healthy weight, particularly while such interventions are in place, and like others, they advocate the use of multi-component interventions (both short and long term in kind).

Three recent major reviews of interventions for obesity were published in 2006. Of these, one is notable for being a meta-analysis of obesity prevention programmes for children and adolescents (Stice, Shaw & Marti, 2006). The authors identified sixty-four prevention programmes, of which only a fifth produced significant effects, a finding which signals the level of difficulty associated with preventing weight gain. However, Stice et al (2006) noted that larger effects were observable for those programmes that were relatively brief, targeted weight control solely, had been trialled in pilot studies and where participants self-selected into the intervention. Surprisingly however, they did not find that involving parents, using trained interventionists to deliver the programmes or reduction in sedentary behaviour were associated with more substantive preventions in weight gain, contrary to the conclusions of Van Sluijs et al (2008) who advocate the involvement of family to support the acquisition of healthy behaviours. Doak, Vissher, Renders & Seidell (2006), in their review of interventions and programmes to prevent overweight and obesity in children and adolescents, examined only school-based studies (twenty-five in all) that focused on changing diet or activity-related behaviours. Unlike other reviews considered so far, they found that a majority (seventeen) produced statistically significant reductions in body mass index or skin-folds and thereby were deemed to be effective. They conclude, like Brown et al (2007), that reduced television viewing and involvement in physical education programmes in schools are examples of successful interventions.

The third major review in 2006, as authored by Flodmark, Marcus & Britton (2006), is notable also for its conclusions about the efficacy of school-based programmes. In a systematic review of interventions to prevent obesity in children and adolescents, they examined twenty-four studies and five other systematic reviews, incorporating results from nearly 34,000 children. Forty percent of those participants benefited from the prevention strategies used, with eight of the twenty-four studies reporting such positive effects, while sixteen reported neutral ones. Thus, only a quarter of the studies reviewed showed the desired effects of intervention. The authors note that school-based programs combining healthy dietary habits and physical activity characterised successful interventions. Their conclusions support the view multi-component school based interventions produce the best results.

Going beyond the responsibility of the individual to change their behaviour within the local contexts of their family, school and wider community, Reilly (2006), reviewing obesity in childhood and adolescence, concludes that *'...large scale actions aimed at making the environment less 'obesogenic' are necessary if the projected increases in prevalence of paediatric obesity are to be avoided'*. This social emphasis

behoves local authorities to examine the development of town-scapes and areas surrounding schools with such a perspective in mind.

A very substantive review of screening and interventions for childhood overweight was published by Whitlock, Williams, Gold, Smith & Shipman (2006), as commissioned by the Agency for Healthcare Research & Quality, USA. This extensive review's conclusions raise a number of points which are of relevance here. Firstly, they concur that adolescents who have a BMI at or above the 95th percentile for their age and sex, *'clearly have an increased probability of adult obesity, and early interventions... would be beneficial'*. However, they note that studies examining the efficacy of interventions among mildly overweight adolescents are needed. They caution however, that a substantial number of children under aged 13 with BMIs above the 95th percentile, will not go on to be obese in adulthood. So, preventative interventions with 11-13 year olds may not be desirable. This recommendation complements the work in England of Wardle, Brodersen, Cole, Jarvis & Boniface (2006) whose longitudinal study over five years of 5863, 11-12 year olds in London found *'...little evidence of new cases of overweight or obesity emerging over adolescence'*. However, Wardle et al note that *'...few obese or overweight adolescents reduced to a healthy weight'*, implicating the need for effective remedial interventions with 14-18 year olds. Wardle et al (2006) conclude that obesity sets in before the secondary school years and that prevention should focus children under the age of 11.

Whitlock et al's (2006) further overviewing includes an evaluation of intensive behavioural counselling interventions that can be delivered in primary care settings and is understated in terms of articulating a positive evaluation of their efficacy. Whilst they note that the number of studies *'...addressing adolescents is small but increasing'*, the authors in effect observe that intensive counselling interventions cannot be delivered in primary care settings to sufficient numbers of young people to impact substantively across the adolescent population as a whole. Thereby, other methods need to be considered. The authors criticise the extant studies for *'...small samples; non-comparable interventions between trials; [and use of] short term (6 to 24 month) follow-up'*, the latter highlighting the need to identify if long-term, positive effects of an intervention occur. So, except for those who are exceptionally obese, Whitlock et al do not recommend one-to-one counselling as a viable intervention for the prevention and remediation of teenage obesity. Berg (2002), however, in a review of the efficacy of counselling in primary care to promote physical activity, concluded that *'...data on the feasibility and on the potential harms of routine physical activity counselling in primary care setting are limited'* and thereby he was unable to say 'for' or 'against' such practice. Contrastingly, Ammerman et al (2002) was of the view that there is sufficient evidence to show that counselling adults and children about various aspects of their diet was viable and efficacious.

Despite the lack of evidence surrounding the utility of counselling methods in primary care settings, it is clear that increasing physical activity and decreasing sedentary behaviour among young people is protective against weight gain in childhood and adolescence. Must & Tybor (2005) carried out a review of twenty longitudinal studies of weight and adiposity in young people and draw such conclusions even though effect sizes were *'...generally of small magnitude'*, attributing this to poor measurement of activity episodes, thereby weakening observed relationships. The conclusions are perhaps indicative of the literature as a whole

which is characterised by a willingness to make much of relatively little in terms of positive results.

A systematic review of randomised trial interventions with one year follow-up for weight control, weight maintenance and weight-loss by McLean, Griffin, Toney & Hardeman (2003) is interesting for its focus upon family involvement. All twenty-one papers which described sixteen intervention studies incorporated a family-based component. Like Whitlock et al (2006), they complain that studies were small, with a mean sample size of only N=52, were mostly north-American and targeted weight reduction. From their review, they concluded that family involvement may improve their effectiveness. They noted that better outcomes are obtained for adolescents if they are treated separately from their mothers wherein the latter provide passive rather than active support. Younger children benefited from parental involvement, with *'effectiveness of interventions [being]...positively associated with the number of behaviour change techniques taught to both parents and children...targeting both parents and children together for weight loss'*. Glenny, O'Meara, Melville, Sheldon & Wilson (1997) in similar vein conclude that for obese children family therapy is effective as a preventative strategy.

7. Intervening in teenage obesity – recommendations & proposal

7.1 Elements of best practice

From the preceding review of preventative strategies and remedial interventions for targeting obesity in childhood and adolescence, it is evident that the following factors are features of successful programmes or are indicated as desirable:

- Remedial interventions must target 14-18 year olds
- Preventative interventions must target children under 11 years of age
- Interventions must have multiple components
- School based - with family involvement, i.e. in partnership
- Family focused – weight reduction for parents, as well as children
- Adolescent treated separately if mother offers passive, not active, support
- A number of behavioural change techniques taught to both parents & children
- Dietary, ‘dieting’ & healthy eating education and change
- Enhanced level of physical activity;
- Reduced sedentary behaviour, in particular television viewing
- In-school physical education programmes
- Long-term follow-up (12 months minimum)
- Weight control targeted
- Methods trialled in pilot studies first
- Participants self-select into interventions
- Intensive interventions to produce significant effects
- Targeting elements of obesogenic environments

It is evident that programmes usually focus on three targets: exercise; food consumption; and sedentary behaviour (in particular television viewing – something which is in need of extending to include other forms of screen use, in particular computer game playing and internet usage, and other potentially passive, technology-mediated pastimes such as listening to music and telephone use). A variety of behaviour change techniques are employed, ranging from psycho-education, cognitive-behavioural interventions, school based exercise programmes, mentor schemes, targeting social cognitions (e.g. attitudes toward food and exercise, intentions to engage in healthy behaviour) and family therapy. The evidence suggests that some form of intervention is better than no intervention at all.

7.2 Missing elements

Though the above factors and desirable elements are all indicated as characteristics of effective interventions, it is notable that they do not address specifically some targets that could be incorporated. For example, while many programmes target dietary issues by educating children about healthy food choices, it is not apparent that the psychological functions of eating are addressed by such. If programmes examined eating as a form of self-comforting, then this would take educational aspects of interventions into an examination of related issues, for example how to cope with difficulties in close relationships. Educational or clinical psychologists, if funded to do so, could provide consultancy to teachers in schools on how best to broach these issues and so could become part of such an intervention.

There are other potential elements of these programmes which have not been incorporated before, and these include:

- Using interventions which lead to the formation of 'implementation intentions' (Golwitzer, 1997; Sheeran, Webb & Golwitzer, 2005) which have been found to be more predictive of health behaviours than simply facilitating the formation of behavioural intentions
- Ensuring the persuasive messages about healthy preventative behaviours are framed in terms of the gains that may accrue, rather than in terms of the losses that might be avoided (as after Kahnman & Tversky's (1979) *Prospect Theory* and as elaborated by Rothman & Salovey (1997) and Salovey & Williams-Peihota, (2004)).

For older adolescents (16 to 18 year olds) it is not evident in the dietary components of intervention programmes that calorific and intoxicant values associated with alcoholic drinks are well elucidated and incorporated. Whilst young people under the age of 18 are not legally entitled to purchase or consume alcohol on public premises, consumption is widespread in the U.K. in this age-group. As in adult samples, it is likely that male and female adolescents are not aware of the recommended daily limits for single session drinking (3 units for women and 4 for men), nor are they conversant with quantities of different types of beverages that constitute one unit of alcohol. Much problem drinking in the U.K. falls within the range of 'moderate' drinking, i.e. by exceeding the recommended daily limits. If indulged in regularly, then such behaviour can contribute to weight gain. So, novel intervention programmes for adolescent obesity should seek to build in education about alcohol consumption. Brief paper-and-pencil interventions in this area have been shown to produce changes in associated cognitions (Murgraff, McDermott & Abraham, 2006).

Dietary education elements of remedial intervention programmes tend to focus on healthy eating ('5 a day' fruit and vegetables, avoidance of sugar snack food and drinks, avoidance of high calorific fast food, eating only at meal times, minimising salt intake). However, less evident in such elements is education about the vagaries of dieting, i.e. rapid weight loss, followed by metabolic change, and then rapid weight regain (so called 'yo-yo dieting'). Yet Ackard et al (2002) has found that overweight or obese middle and high school children and adolescents are more likely to have '*...dieted in the past year, to be trying to lose weight currently, and to report that weight and shape are very important to their overall feelings about self*'. Evidently then obese and overweight adolescents are likely to be dieting by attempting to restrict food intake and thereby need to be educated about the efficacy of such behaviour.

Another way in which intervention programmes fail to be sufficiently complex is that they tend to take a 'one size fits all approach' to prevention and remediation, rather than tailoring interventions to particular sub-groups. Though some programmes have managed to target girls versus boys and particular ethnic groups, little attempt has been made to tailor interventions to take account of disaffected, oppositional adolescents, yet one in five adults report going through a period of rebelliousness during adolescence (Balswick & Macrides, 1975). Health outcomes and behaviours have been shown to covary with rebelliousness. In a study of over 4,500 Dutch

participants by Klabbers, Bosma, van den Akker, Boxtel, Kempen, McDermott & van Eijk (in submission) rebelliousness in young people has been found to be associated with higher levels of drinking and smoking and lower levels of physical activity. So, it is evident that some components of interventions need to be tailored to address those adolescents who habitually resist influence and to behave in required ways. One technique here is to employ 'paradoxical intent', that is to advocate the opposite of what is trying to be achieved. The inherent humour of such a tactic can appeal to a disaffected adolescent and break through the resistance that stops him or her from embracing behavioural change.

More recently, one or two studies have pointed to the utility of using financial incentives to produce behavioural change and weight loss amongst overweight adolescents and their parents. Whilst this method draws on the power of reinforcement (as after Thorndike's Law of Effect and Skinner's extensive work on operant conditioning), it is not clear in the long-term what will happen once those extrinsic reinforcers are withdrawn. Programmes which rely on the intrinsic rewards of participation in new behaviours or behaviours that lead to increases in self-esteem or enjoyment with others in a social setting arguably are more desirable and ethical. The latter points to the importance of celebrating the weight maintenance or loss successes of over-weight children. Instigating a hierarchy of rewards (prizes, weekly awards) which confer status upon the individuals is a strategy which may have particular salience to adolescents, who like adults, are concerned about their standing, status and reputation amongst their peers. Indeed, Emler (1990) and Emler & Reicher (1995) have written and researched extensively about the importance of 'reputation management' in adolescent peer groups.

7.3 Intervention recommendations

What is clear from the overview of previous reviews is that remedial interventions for obesity in 14-18 year olds must be multi-componential and multi-level, and must incorporate elements of best practice and missing elements as identified in the preceding review.

At the centre of such a programme must be behaviour change techniques, since helping people to modify obesogenic activity at the individual level must be at the centre of any such endeavour. Abraham and Michie (in press) have developed a taxonomy of generally-applicable behaviour change techniques (BCTs) which could be incorporated into a novel multi-component and multi-level remedial intervention programme for obesity in adolescence. Many of these techniques or combinations of them are associated with effectively changing physical activity and healthy eating behaviors and thereby with intervening in obesity. A new and innovative intervention programme for obesity should seek to include as many of these BCTs as possible. Indeed, such a behaviourally-based programme is likely to be cost effective and consistent with the development of public policy (Halpern, Bates, Beales & Healthfield, 2004). In all Abraham & Michie have identified twenty-six behaviour change techniques (see Table 2).

1. Provide general information linking behaviour to health
2. Provide information on consequences
3. Provide information about others' approval
4. Prompt intention formation
5. Prompt barrier identification
6. Provide general encouragement
7. Set graded tasks
8. Provide instruction
9. Model/ demonstrate the behaviour
10. Prompt specific goal setting
11. Prompt review of behavioural goals
12. Prompt self-monitoring of behaviour
13. Provide feedback on performance
14. Provide contingent rewards
15. Teach to use prompts/ cues
16. Agree behavioural contract
17. Prompt practice
18. Use follow up prompts
19. Provide opportunities for social comparison
20. Plan social support/ social change
21. Prompt identification as role model
22. Prompt self talk
23. Relapse prevention
24. Stress management
25. Motivational interviewing
26. Time management

Table 2: Twenty-six behavioural change techniques

As well as being multi-faceted, interventions must take place that involve both home and school, and ideally involve school and family in a vigorous, engaging, dynamic partnership, with parents and teachers acting in unison, rather than separately within their respective domains.

Another important feature of any intervention programme is that built into its design must be the capacity to evaluate its efficacy. This can be achieved by a developing a programme which has a number of 'conditions' or trajectories within it, for example two or three trajectories which are carefully controlled variants of a programme, and as compared with a 'no treatment' or 'standard treatment' condition. Random assignment of participants to conditions is usual in such designs, however the need for participants to self-select into elements of programmes is likely to mitigate against this. Also, well designed programmes must be longitudinal in nature, thereby involving initial interventions the effects of which are followed up at intervals over time – in this way cause and effect relations can be teased apart. If programmes are to involve multiple sites, then it will be important to ensure that standardisation of instruction to site co-ordinators is achieved via centralised training. Interventions that

are theory-based are desirable since they make clear why they work and thereby facilitate an opportunity to improve upon them and develop them across different contexts.

Remedial interventions for adolescent overweight and obesity need also to be located within ongoing public health strategy as explicated within the NHS Plan and by NHS London, the Strategic Health Authority for London which came into being on 1st July 2006. In particular, such a programme should seek to draw upon and finesse initiatives laid down in the cross-government obesity programme and strategy for England '*Healthy Weight, Healthy Lives*' in which guidance for local areas is explicated about choosing interventions, including promoting healthier food choices, building physical activity into our lives, creating incentives for better health, personalised support, and support delivery through effective marketing. Guidance for primary care trusts and local authorities is also available therein regarding setting, monitoring and evaluating child obesity prevalence and on building local capabilities.

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