Effective Health Care

Bulletin on the effectiveness of health service interventions for decision makers

This bulletin summarises the research evidence on the prevention and treatment of childhood obesity.

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The prevention and treatment of childhood obesity

- Obesity is now considered to be a global epidemic. In the UK, the prevalence of overweight and obesity amongst children of all ages is increasing.

- There is debate around the reasons for the increasing prevalence of childhood overweight and obesity, and possible explanations include an increase in sedentary lifestyles and changes in dietary patterns and eating habits.

- Halting the rising prevalence of childhood obesity is a public health priority. However, there is a lack of good quality evidence on the effectiveness of interventions on which to base national strategies or inform clinical practice.

- Currently there are a number of government initiatives specifically targeting schools and there is some evidence that school-based programmes that promote physical activity, the modification of dietary intake and the targeting of sedentary behaviours may help reduce obesity in children, particularly girls.

- Family-based programmes that involve parents, increase physical activity, provide dietary education and target reductions in sedentary behaviour may help reduce childhood obesity.

- Future research must be of good methodological quality, involve large numbers of participants, be carried out in appropriate settings and needs to be of longer duration and intensity.

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A. Background

Obesity is now considered to be a global epidemic.[1] UK research suggests that the prevalence of overweight and obesity amongst children of all ages is increasing.[2-4] One study has reported substantial increases (between 1984 and 1994) in the prevalence of overweight and obesity amongst primary school children in England and Scotland.[5] Additionally, data from a large survey in England showed a rise in the prevalence of overweight (14.7% to 23.6%) and obesity (5.4% to 9.2%) between 1989 and 1998 in pre-school children.[6] Estimates of actual figures vary due to an ongoing discussion as to how best to measure childhood obesity.[7] There is no consensus on the appropriate cut-off point for classifying a child as obese (BMI changes substantially depending on the age, height and gender of a child).[8,9]

There is considerable debate around the reasons for the increasing prevalence of childhood overweight and obesity. Possible explanations include an increase in sedentary lifestyles and changes in dietary patterns and eating habits.[9] Among adults it appears that average recorded energy intake in Britain has declined substantially as obesity rates have escalated, which may suggest that sedentary lifestyles are an important factor.[10,11]

The National Diet and Nutrition Survey (published 2000) found that 40% of boys and 60% of girls surveyed were failing to meet a Health Education Authority recommendation that young people should participate in physical activity of at least moderate intensity for one hour per day.[12] The survey also found that children's consumption of fruit and vegetables has been falling over the last 20 years, with more than half of those surveyed eating no fruit or vegetables in a given week.[12] Additionally, the Poverty and Social Exclusion Survey (published 2000) reported that around one in ten 'poor children' did not eat fresh fruit or vegetables daily.[13]

Obesity in childhood can cause dyslipidaemia, hyperinsulinaemia and hypertension.[14] Additionally, the first obesity-related cases of type 2 diabetes in white adolescents have been reported in the UK.[15] Overweight and obesity are also known to have a significant impact on psychological wellbeing, with many children developing a negative self image and experiencing low self-esteem.[16,17]

B. Current initiatives

Halting the rising prevalence of overweight and obesity in children is a public health priority. The NHS Plan stated an intention to tackle obesity and physical inactivity,[18] and there are now a number of government initiatives specifically targeting schools and school children.[9] The Healthy Schools Programme[19] aims to make children, teachers, parents and local communities more aware of the opportunities that exist in schools for improving health. A key part of the Programme is the National Healthy School Standard, a national guidance and accreditation process to support the development of healthy schools through local educational and health partnerships.[20] Other components of the Healthy Schools Programme include the National School Fruit Scheme and the Safe Active Travel to School. The National School Fruit Scheme aims to promote healthier eating by providing all four to six year olds with a free piece of fruit each day.[21] The Safe Active Travel to School initiative focuses on strategies to reduce car journeys to school where safer, healthier alternatives exist.[22]

Primary and community health professionals, including GPs, practice nurses, dieticians, health visitors and school nurses can play an important role in the recognition and management of childhood obesity. Guidelines on the weight management of children and adolescents in primary care have been published by the Royal College of Paediatrics and Child Health in conjunction with the National Obesity Forum.[23] The Scottish Intercollegiate Guidelines Network is also producing guidance on the management of obesity in children and young people in primary care.[24] A forthcoming publication from the Health Development Agency also focuses on obesity and overweight in children and adults.[25] Finally, the forthcoming Children's National Service Framework will address childhood obesity as part of the broader issues around promoting a healthy diet and physical activity.[26]

A survey conducted by the National Audit Office found that there was uncertainty amongst GPs and practice nurses about the effectiveness of available treatment options.[9] In the same survey, GPs suggested better information about proven effective interventions would assist them in referring patients more effectively and efficiently.[9] As such, this issue of *Effective Health Care* summarises the research evidence on the effectiveness of a range of interventions used in the prevention and treatment of childhood obesity.

C. Nature of the evidence

Based upon updated Cochrane reviews,[27,28] this bulletin focuses on the effectiveness of interventions in the prevention and treatment of childhood obesity. The Cochrane review on prevention included non-randomised studies, however this bulletin focuses exclusively on randomised controlled trials (RCTs).[29-64] Further details of methods are available in the Appendix.

Many of the included RCTs have methodological problems such as small sample sizes and high rates of attrition (drop-outs), leading to low statistical power and potential bias. In addition, many are poorly reported. For example, trial authors rarely give sufficient detail about the method of randomisation.

Many of the interventions have been evaluated in only one or two studies and most of the research has been conducted in North America. Only one study was conducted in a UK setting.[32] Many of the studies recruited children either through existing specialist obesity centres or media advertisements. As such,

Table 1: RCTs evaluating school-based programmes

Author, country, year	Participants	Interventions, duration	Results	Comments
Health promotion				
Robinson[29] USA 1999	School children (grades 3-4) Mean age: 8.9 yrs % female: not given	I: An 18-lesson, 6-month classroom curriculum to reduce television, videotape, and videogame use (n=106) C: Usual school curriculum (n=121) Follow-up: 7 months	*Adjusted change in BMI (kg/m2)* -0.45 (95% CI: -0.73, -0.17, p=0.002) Significantly greater reductions were also observed in the I group in terms of triceps skinfold thickness (p=0.002), waist circumference (p<0.001) and waist-to-hip ratio (p<0.001) Intervention group children watched significantly less television (p<0.001) and played less video games (p<0.01) than control group children. The groups did not differ for videotape viewing, daily servings of high fat foods, physical activity levels, or cardio-respiratory fitness	Random allocation: Schools matched on sociodemographic and scholastic variables Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Physical activity				
Sallis[31] USA 1993	School children (grade 4) Mean age: 9.25 yrs 44% female	Followed the Sports, Play, Active Recreation for Kids (SPARK) intervention, incorporating physical education and self-management into the school curriculum over an 18 month period I1. Intervention led by certified physical education specialists (n=151) I2. Intervention led by classroom teachers (n=200) C: No intervention (n=198) Follow-up: 18 months	Results were presented as graphs only. Few significant differences were reported between the groups in terms of BMI or triceps/calf skinfolds (adiposity)	Random allocation: Schools stratified by % of ethnic minority students and size Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Mo-Suwan[30] Thailand 1998	Kindergarten children Mean age: 4.5 yrs Sex: I=44% female C=39% female	I: Kindergarten-based physical activity programme conducted by specially trained staff and including a 15 minute walk and a twenty minute aerobic dance session 3-times a week. (n=158 baseline, 147 at end of study) C: no intervention (n=152 baseline, 145 at end of study) Follow-up: 29.6 weeks (the end of the intervention)	Prevalence of obesity: *Baseline: I=12.2%, C=11.7% 29.6 weeks: I=8.8%, C=9.7%, p=0.057*	Random allocation: Randomisation of classes, stratified by school Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Multifaceted interventions				
Sahota[32] UK 2001	School children (aged 7-11 years) Mean age: I=8.36 yrs, C=8.42 yrs Sex: I=49% female C=41% female	I: Active Programme Promoting Lifestyle in Schools (APPLES). Programme designed to influence diet and physical activity and not simply knowledge. Targeted at the whole school community including parents, teachers and catering staff. The programme consisted of teacher training, modifications of school meals and the development and implementation of school action plans designed to promote healthy eating and physical activity (data collection: n=301 baseline, 292 follow-up) C: No intervention (data collection: n=312 baseline, 303 follow-up) Follow-up: One year	*Weighted mean difference in BMI:* Overweight children: -0.07 (95% CI: -0.22, 0.08) Obese children: -0.05 (95% CI: -0.22, 0.11) All children: 0 (95% CI: -0.1, 0.1)	Random allocation: Ten schools paired according to size, ethnicity and level of social disadvantage, randomised by coin toss Blinding: · Children: Unclear · Providers: No · Outcome assessors: No
DeWolfe[33] Canada 1984	Adolescent girls at least 5lbs overweight Mean age: 15.9 yrs	All participants attended an 8-week school-based weight control programme, containing physical exercise and behavioural therapy components I1: Monthly follow-up with physical measurement, plus reinforcement of behavioural, diet and exercise components of the weight control program (n=4) I2: Monthly follow-up with physical measurement (n=6) I3: Annual follow-up with physical measurement (n=5) Follow-up: One year	% change in excess weight During programme: I1= -9.6, I2= -9.5, I3= -10.5 During follow-up: I1= -26.4, I2= -19.9, I3= +40.6 Overall: I1= -34.1, I2= -24.7, I3=+21.1 Similar results for weight change and percentage weight change. Significance not assessed, due to small number of participants involved	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Flores[34] USA 1995	School children (aged 10-13 years) Mean age: 12.6 yrs 54% female	I: Thrice-weekly aerobic dance class plus health education in place of regular school physical education programme (n=43) C: Usual physical activity (n=38) Follow-up: 12 weeks	*For girls:* Change in BMI; I=-0.8, C=+0.3, p=<0.05 Change in heart rate (beats per min); I=-10.9, C=-0.2, p<0.01 For boys, there were no differences between I and C groups	Random allocation: Randomisation of classrooms Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Gortmaker[35] USA 1999a	School children (grades 6-8) Mean age: 11.7 yrs 48% female	I: School-based interdisciplinary intervention focused on decreasing television viewing, decreasing consumption of high-fat foods, increasing fruit and vegetable consumption and encouraging increases in physical activity (n=641) C: No intervention (n=654) Follow-up: 18 months (2 school years)	*Change in prevalence of obesity in girls (%):* C=+2.2, I=-3.3 Adjusted OR=0.47 (95% CI: 0.24, 0.93, p=0.03) *Change in prevalence of obesity in boys (%):* C=-2.3, I=-1.5 Adjusted OR=0.85 (95% CI: 0.52-1.39, p=0.48)	Random allocation: Ten schools matched according to town, size and ethnic composition, randomised using random number table Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Muller[36] Germany 2001	School children Mean age: not given. Age range 5-7 yrs % female: not given	I: At school, an 8 hour course of nutrition education including 'active' breaks given by a skilled nutritionist and a trained teacher. Included the following messages: 'eat fruit and vegetables each day', 'reduce intake of high fat foods', keep active at least 1 hour each day', 'decrease TV consumption to less than 1 hour per day'. (Additional family-based intervention plus a structured sports programme were offered to families with overweight or obese children and to families with normal weight children but obese parents) (n=136) C: No intervention (n=161) Follow-up: One year	*Median BMI (baseline, 1 year)* I=15.2, 16.1 C=15.4, 16.3 p=n.s. *Median triceps skinfold (mm): (baseline, 1 year)* I=10.9, 11.3 C=10.7, 13.0 p<0.01	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear

Table 2: RCTs evaluating the effects of family-based interventions

Author, country, year	Participants	Interventions, duration	Results	Comments
Health promotion				
Stolley[37] USA 1997	African American girls (aged 7-12 years) and their mothers Mean age: I=9.9yrs, C=10.0 yrs 62% of the mothers and 19% of the daughters were obese	I: 12-week culturally specific obesity prevention programme, focused on adopting a low-fat, low-calorie diet and stressing the importance of increased activity (n=32) C: general health programme, focused on communicable disease control, effective communication skills, relaxation techniques, and stress reduction (n=33) Both groups led by either a doctoral clinical psychology student or registered dietician Follow-up: 12 months (only 12-week data reported)	Significant between group differences, with treatment mothers consuming less daily saturated fat (-2.1oz, P <0.05) and a lower percentage of calories from fat (-7.9%, P <0.001) Weight remained unchanged (no figures reported) Differences among treatment and control groups were noted for the daughters' percentage of daily calories from fat (-3.9%, P <0.05) Post treatment weight and BMI figures not reported	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Epstein[38] USA 2001	Non obese children from families with at least one obese parent Mean age: I=8.6 yrs, C=8.8 yrs 65% female	Both groups received same 6-month treatment and followed the 'traffic light' diet, but targeted different dietary goals. Treatment meetings were facilitated by therapists I: increased fruit and vegetable intake (n=13) C: decreased intake of high fat/high sugar foods (n=13) Follow-up: One year	*Percentage of overweight:* Parents in the increased fruit and vegetable group showed significantly greater decreases (p<0.05) in percentage of overweight than parents in the decreased high-fat/high-sugar group, while children showed a stable percentage of overweight over time	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Nova[39] Italy 2001	Obese children (at least 20% above ideal weight, aged 3-12 yrs) and their parents and family paediatricians Mean age: 8.6yrs (both groups) 44% female	I1 Family paediatricians provided children and families with leaflets only containing general information regarding obesity and associated risks, general advice on healthy eating, and an invitation to practise some physical activity (n=113) I2 Family paediatricians provided children and families with information on a specific diet (allowing 1400 calories), detailed guidelines regarding physical activity and active parental commitment, and a food diary with instructions for use (n=72) Follow-up: One year	Mean (SD) change in % overweight 0-6 months: I1 (n=92) =-2.95 (8.47), I2 (n=51) =-8.80 (6.62), p=0.0001 0-12 months: I1(n=80) =-2.92 (10.8), I2 (n=50) =-8.50 (9.72), p=0.002 6-12 months: I1 (n=73) =-0.30 (6.19), I2 (n=45) =-0.64 (8.05), p=0.8	Random allocation: Cluster randomisation by family practitioner Blinding: · Children: Unclear · Parents: Unclear · Outcome assessors: Unclear
Physical activity and health promotion				
Epstein[40] USA 1984	Obese children (aged 8-12 years) and their parents Mean age: not given % female	Intervention groups attended 15 education sessions; 8 weekly sessions, the remaining 7 sessions spread out over 20 wks I1: Traffic Light Diet (n (baseline, 6 months)=18, 15) I2: Traffic Light Diet plus increase in exercise programme (n (baseline, 6 months)=18, 15) C: Waiting list control (n (baseline, 6 months)=17, 14) Follow-up: 2, 6 and 12 months	At 6 months, children in the treatment groups were significantly (p<0.01) lighter than children in the control group, who gained weight At 6 and 12 months, treatment groups differed significantly in percentage overweight from baseline (p<0.0001), but not between groups	Random allocation: Stratified by relative weight Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Epstein[41,46] USA 1985	Obese children (aged 8-12 years) and at least one parent Mean age: not given 60% female	I1: Diet plus programmed aerobic exercise (walk, run, cycle or swim) (n=13) I2: Diet plus 'lifestyle' exercise programme (not instructed to exercise at a particular intensity) (n=12) I3. Diet plus calisthenic exercise programme (3 times per week) (n=10) 8 weekly sessions of treatment and 10 monthly maintenance sessions. Participants also followed a 1200kcal/d diet, based on the 'traffic light diet' and sessions included behaviour modification Follow-up: 12 and 24 months	Percentage overweight Baseline: I=47.8, I2=48.3, I3=48 12 months: I=31.5, I2=32.2, I3=30.5 24 months: I=41, I3=30.3, I3=40.8 At 24 months, percentage overweight was significantly smaller (p<0.05) in lifestyle group than the aerobic or calisthenic group. Change in percentage overweight 10 years I1=-19.7 I2=-10.9 I3=+12.2	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Epstein[42] USA 1985	Obese girls (aged 8-12 years) and at least one parent Mean age: not given 100% female	Intensive 8 week treatment programme followed by 10 monthly maintenance sessions. Sessions incorporated diet and nutrition education, exercise education (group 1 only) and behavioural procedures I1: Diet plus aerobic exercise programme (n=not given) I2: Diet without exercise (n=not given) Follow-up: 6 and 12 months	Mean percentage overweight Baseline: I1=48, I2=48.1 6 months: I1=20.5, I2=29.3. Both groups significantly different from baseline p<0.01. Significant between group difference p<0.05. 12 months: I1(n=10) =22.6, I2(n=9) =29.4. Both groups significantly different from baseline p<0.01	Random allocation: Stratified by age, % overweight and physical work capacity Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Epstein[43] USA 1995	Obese children (aged 8-12 years) and their parents. Mean age: 10.1 yrs 73% female	Comparisons of diet and physical activity reinforcement regimes I1: reinforcing a reduction in sedentary behaviours (n=not given) I2: reinforcing an increase in physical activity (n=not given) I3: reinforcing a reduction in sedentary behaviours and an increase in physical activity (n=not given) All groups received 4 months treatment and followed the Traffic Light Diet Follow-up: One year	Change in percentage overweight One year: I1=-18.7, I2=-10.3, I3=-8.7 Significantly larger decrease in intervention than control groups (p<0.05) Change in percentage of body fat: I1=-4.7, I2/I3=-1.3 p<0.05	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Johnson[45] USA 1997	Obese children (aged 8-17 years) and their parents Mean age: 11.0 yrs 72% female	I1: 7-week nutrition and eating-habit intervention, followed by 7-week aerobic exercise intervention (n=9) I2: 7-week aerobic exercise intervention followed by 7-week nutrition and eating-habit intervention (n=10) C: 14-week education on diet and exercise with instructions for behavioural changes (n=9) Follow-up: 9 weeks, 16 weeks and 5 years (n=6 in each group at 5-year follow-up)	Mean weight (kg) Week 1: I1=73.2, I2=72.0, C=68.6 Week 9: I1=72.0, I2=73.4, C=68.5 Week 16: I1=70.8, I2=71.0, C=68.9 Change in weight over weeks 1-16 significant for I1 (p<0.01) Change over weeks 9-16 significant for I2 (p<0.01). Mean % of ideal body weight (pre-treatment, 5-year follow-up) I1=168.8, 137.3 I2=153, 137.8 C=186.5, 175.2 I1 and I2 both significantly lower than C (p<0.01)	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear

Table 2 (continued): RCTs evaluating the effects of family-based interventions

Author, country, year	Participants	Interventions, duration	Results	Comments
Epstein[44] USA 2000b	Obese children (aged 8-12 years)) and at least one parent Mean age: 10.5 68% female	I: Increasing physical activity (high dose, n=19 low dose, n=18) C: Decreasing sedentary behaviour (high dose, n=20; low dose, n=19) Both groups received 6-months treatment and followed the 'traffic light' diet Follow-up: 12 and 24 months	Change in percentage overweight from baseline (mean, SD) 0-6 months: I: low dose=-25.6 (8.1), high dose=-26.4 (10.5) C: low dose=-22.4 (12.6), high dose=-27.4 (10.7) All significant (p<0.01) 0-24 months: I: low dose=-12.4 (13.3), high dose=-13.2 (16.4) C: low dose=-11.6 (21.9), high dose=-14.3 (16.9) All significant (p<0.01)	Random allocation: Families stratified by gender and degree of child and parent obesity Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear

results from these studies may not be applicable to children and their families in other settings.

Thirty-five RCTs have been included in this bulletin and are presented according to the study setting (school- or family-based) and the type of intervention. Only studies with over 20 participants have been reported in the text. Details on, and results for all of the included RCTs are reported in Tables 1–3.

D. Effectiveness

D.1. School-based programmes

Health promotion

One school-based RCT (n=227) assessed the effects of using a classroom-based curriculum to reduce television, videotape, and video game use on changes in physical activity, dietary intake and obesity (adiposity).[29] At seven months follow-up, children in the intervention group (n=106) were found to watch significantly less television and play less video games than control group children. Intervention group children also had statistically significant decreases in BMI, triceps skinfold thickness, waist circumference and waist-to-hip ratio compared with the control group.

Physical activity

Two school-based RCTs suggest that active programmes of physical activity are not enough to reduce levels of obesity in children of primary school age (Table 1).[30,31]

In the first RCT (n=310), trained staff encouraged infant school classes (mean age 4.5 years) to take part in a 30-week exercise programme.[30] At the end of the programme, there were no statistically significant differences between those children that exercised and those in the control group, although the prevalence of obesity decreased in both groups of children.

The second RCT evaluated a physical education programme (Project SPARK) designed to provide high levels of exercise for children in three 30-minute sessions per week over an 18-month period.[31] The children in the two exercise groups were led by either specialist PE teachers or classroom teachers. 549 children (aged 8–9 years) from seven schools completed the programme. At the end of the programme, there were no statistically significant differences found in either BMI or adiposity between those in the exercise and those in the control groups.

Multifaceted interventions

There is some evidence to suggest that multi-faceted interventions may help to reduce obesity in school children, particularly girls (Table 1). Results from the smallest[33] of the five RCTs (n=15) are reported in the table only.[32-36]

The Active Programme Promoting Lifestyle in Schools (APPLES) RCT (n=636) included children aged 7–11 years.[32] The programme consisted of teacher training, modification of school meals, the development of school action plans targeting the curriculum, physical education, tuck shops, and playground activities, and was compared to a no intervention control group. Ten primary schools were randomised, and at one year, there was no difference in change in BMI scores between the two groups. The APPLES programme had little effect on children's eating behaviour other than a modest increase in the consumption of vegetables.

The Kiel Obesity Prevention Study (KOPS) was a primary school-based intervention which assessed the additional impact of a family-based programme, for obese children or normal weight children with obese parents (n=297).[36] This RCT examined the combined effects of dietary education and exercise in which both the children and their parents were instructed to eat fruit and vegetables each day, reduce high-fat foods, keep active at least one hour a day, and decrease TV viewing. Control children received no intervention. At one year, there were no statically significant differences in mean BMI scores between the two groups. However there were significant differences in terms of triceps skinfold thickness in favour of the intervention group.

A large RCT (n=1295) involving the multi-faceted 'Planet Health' programme, targeted older children (aged 11–13 years).[35] This programme promoted physical activity, modification of dietary intake and reduction of sedentary behaviours. Control schools received their usual health curricula and physical education classes. After 18 months, the prevalence of obesity among girls in the intervention schools was reduced compared with controls (OR, 0.47; 95% CI: 0.24-0.93; p=0.03). In addition, there were fewer obese girls in the intervention group than in the control group (OR, 2.16; 95% CI: 1.07-4.35; p=0.04). The programme significantly reduced television viewing hours for both boys and girls.

In a much smaller RCT, school children (aged 10–13 years) took part in a 12-week 'Dance for Health' programme, to assess whether thrice-weekly aerobic dance classes plus health education (n=43) had a greater impact on increasing aerobic capacity, maintaining or decreasing

weight and improving attitudes towards fitness, than usual physical education (n=38).[34] At the end of the programme there was a statistically significant decrease in BMI and change in heart rate for girls in the intervention group compared to those in the control. There were no statistically significant differences between the groups for boys.

D.2. Family-based interventions

Health promotion

Evidence from three RCTs[37-39] (Table 2) suggests that programmes that focus on promoting healthy eating and physical activity, and involve sustained contact with children and parents, may effect changes in the dietary habits of those targeted, but effects on weight are less clear.

In the first RCT (n=55), a culturally specific obesity-prevention programme (which stressed the importance of eating a low-fat, low-cholesterol diet and increasing activity) was compared with a control group that took part in general health education.[37] At the end of the 12-week study there was a statistically significant difference in favour of the intervention group in terms of the percentage of daily calories from fat. Weight remained unchanged in the mothers and was not reported for the daughters.

In the second RCT, 26 families with non-obese children who had obese parents were randomised to groups that encouraged fruit and vegetable intake or decreased intake of high-fat/high-sugar foods.[38] At one-year follow-up, there was a statistically significant greater decrease in percentage overweight in favour of parents in the increased fruit and vegetable group, but no significant between-group differences in percentage overweight for children.

The third RCT (n=185) compared two types of intervention (routine general information leaflet versus enhanced information about a specific diet, physical activity, active parental commitment, and food diary) delivered by family paediatricians in primary care.[39] At one-year follow-up, although both intervention groups showed a reduction in percentage overweight

from baseline, the reduction was significantly greater in the enhanced information group compared to the routine information group.

Physical activity and health promotion

There is some evidence that family-based programmes which actively increase physical activity, provide dietary education and target reductions in sedentary behaviour may help children lose weight.

Six RCTs evaluated the effects of increased physical activity combined with dietary education (Table 2). All of the family-based trials involved the participation of at least one parent. Five of the RCTs were conducted by the same lead researcher.[40-44] In the other RCT (n=32), as only 18 of the participants remained at five-year follow-up, results are reported in the table only.[45]

In the first of the RCTs by the same lead researcher (n=53), dietary education was compared with dietary education plus exercise and (for the first six months only) a waiting list control.[40] At 12 months, a statistically significant decrease in terms of percentage overweight from baseline was found for both intervention groups, but there were no differences between the two groups. In the second RCT (n=23) comparing dietary education with dietary education plus exercise, statistically significant decreases in percentage overweight from baseline were observed for both groups.[42] At six months (but not 12 months) follow-up, the dietary education plus exercise group showed a statistically significant greater reduction in percentage overweight than the diet only group.

The third RCT (n=35) compared a callisthenics group, a lifestyle exercise group, and an aerobic exercise programme.[41] All groups also received dietary education. Whilst children in each group experienced reductions in percentage overweight during the first 12 months of the study, there were no statistically significant differences between groups. At 24 months, the percentage overweight for the lifestyle group was significantly smaller than those for

the callisthenics and aerobic groups. Analysis at ten-year follow-up, indicated that children in the lifestyle and aerobic exercise groups had achieved a statistically significant greater reduction in percentage overweight than the callisthenics group.[46]

The remaining two RCTs (n=61, n=90) compared the effects of increasing physical activity versus decreasing sedentary behaviour.[43,44] Participants in both studies were also given the 'traffic light' diet to follow. At one year follow-up in the first RCT, all groups (increased exercise, decreased sedentary behaviours or both) had lost weight compared with baseline.[43] However, children in the reduced sedentary behaviour group showed a statistically significant greater reduction in percentage overweight compared to the other groups. In the other RCT, all groups (high or low increased physical activity, high or low decreased sedentary behaviours) showed significant decreases in percentage overweight at six and 24 months compared with baseline.[44] However, the differences between the groups were not statistically significant.

D.3. Behaviour modification programmes

Family-based programmes with parents as agents of change

There is some evidence that behaviour modification programmes where parents take primary responsibility and act as agents of change, may help children of primary school age lose weight.

Six RCTs were identified which evaluated the effects of parents taking primary responsibility for behaviour change. The results of two small trials (n=19, n=20) are reported in the table only.[47,48]

In one RCT (n=33), overweight children (aged 8–12 years) and their parents were assigned to a multi-component behavioural Weight Reduction Only programme, a Parent Training programme involving the same multi-component weight reduction behavioural treatment preceded by a short course for parents in child management skills, or a waiting list control.[49] At one-year

Table 3: RCTs evaluating the effects of behaviour modification programmes

Author, country, year	Participants	Interventions, duration	Results	Comments
Family-based programmes with parents as agents of change				
Epstein[47] USA 1985c	Obese girls (aged 5-8 years) Mean age: not given 100% female	I: Diet and exercise information plus information on parent management techniques and social learning principles (n=8) C: Diet and exercise information alone (n=11) Follow-up: 12 months	Mean (SD) percentage overweight Baseline: I=41.9 (13.6), C=39.2 (17.1) 12 months: I=15.6 (15.2), C=28 (16.7) (p<0.05) Mean (SD) BMI Baseline: I=22.8 (2.6), C=22.7 (3) 12 months: I=19.1 (2.8), C=21.4 (3.3) (p<0.05)	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Israel[49] USA 1985	Overweight children (aged 8-12 years) Mean age: 11 yrs, 4 months % female: not given	I1: Weight Reduction Only (WRO); multicomponent behavioural weight reduction programme (n=12) I2: Parent Training (PT); as WRO, but preceded by short course for parents in general child management skills (n=12) C: Waiting-list control (n=9) Follow-up: 12 months (I1: n=11; I2: n=9)	Mean % overweight Week 1: I1=53.15, I2=45.88, C=56.02 Week 9: I1=41.49, I2=38.71, C=55.09 Change in % overweight at 9 weeks lower in I1 than I2 group (p<0.025), and lower in I2 than C group (p<0.01) One year: I1=45.53, I2=40.40 Change in % overweight at 1 year increased in I1 group compared to I2 (p<0.001)	Random allocation: Stratified blocks based on child percent overweight and age. Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Mellin[50] USA 1987	Obese adolescents (aged 12-18 years) Mean age: 15.6 yrs 79% female	I: 14 x 90 minute sessions using the materials of the SHAPEDOWN programme (encouraging adolescents to make small sustainable changes in diet, exercise, lifestyle and attitudes) plus 2 parent sessions (n=37) C: No intervention (n=29) Follow-up: 15 months from start of intervention	Mean weight change (kg) 3 months: I=-3.11, C=+0.13 6 months: I=-1.40, C=-1.05 15 months: I=-3.88, C=+1.27 Intervention group displayed overall mean weight loss of 5.15kg compared to control group Programme participation was also associated with a post-treatment and 1-yr follow-up reduction in relative weight	Random allocation: Method not described Blinding: · Children: No · Providers: No · Outcome assessors: Unclear
Israel[48] USA 1994	Obese children (aged 8-13 years) Mean age: 10 yrs 11 months. % female: not given	Parents and children met separately for 8 x 90 minutes sessions followed by 9 biweekly sessions for a total of 26 weeks. Treatment consisted of discussions and homework assignments I1: Standard treatment condition (n=18) I2: Enhanced child involvement (n=16) Follow-up: 1 and 3 years (I1: n=11; I2 n=9)	Mean percentage overweight Week 1: I1=45.94, I2=48.10 Week 26: I1=33.43, I2=32.55 1 year: I1=45.15, I2=42.32 3 years: I1=52.30, I2=43.29 Mean percentage over triceps norm Week 1: I1=131.65, I2=118.43 Week 26: I1=101.3, I2=82.99 1 year: I1=129.83, I2=132.68 No significant between group differences	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Epstein[51] USA 1994a	Obese children (aged 8-12 years) and their parents. Mean age: 10.2 yrs 74% female	I: Parents and children targeted and reinforced for mastery of diet, exercise, weight loss and parenting skills (n=17) C: participants taught behaviour change strategies and provided non-contingent reinforcement at a pace yoked to the intervention group. (n=22) Intervention given over 26 weekly meetings and 6 monthly meetings Follow-up: 2 years	Mean percentage overweight Baseline: I= 60.6, C=58.8 6 months: I= 30.5, C=38.8 (p<0.05) 12 months: I=34.1, C=42.1 (p<0.05) 24 months: I=45.2, C=48.2 (p<0.3)	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Golan[52] Israel 1998	Obese children (aged 6-11 years) Mean age: 9.2 yrs 62% female	I: Behavioural modification targeted at parents as agents of change. 14 sessions (n=30) C: Children as agents of change. 30 sessions (n=30) Hour long support and educational sessions were conducted by a clinical dietician. Follow-up: 6 and 12 months	Percentage overweight I: Baseline: 39.6 One year follow-up: 24.9 (p<0.001) C: Baseline: 39.1 One year follow-up: 31.0 (p<0.01) Reduction over one year was significantly greater in I group than C group (p<0.03)	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Family-based behaviour modification programmes				
Brownell[55] USA 1983	Obese adolescents (aged 12-16 years) and mothers Mean age: not given 79% female	Programme of behaviour modification, nutrition education, exercise instruction and social support I1: Mothers and children met concurrently in separate groups (n (baseline, 16 weeks, 1year)=14, 13, 12) I2: Children and mothers attended all sessions in the same group (n (baseline, 16 weeks, 1year)=15, 13, 12) I3: Children met in groups, mother did not take part in formal treatment programme (n (baseline, 16 weeks, 1year)=13, 13, 13) Follow-up: 12 months	Change in % overweight 16 weeks: I1=-17.1, I2=-7.0, I3=-6.8 1 Year: I1=-20.5, I2=-5.5, I3=-6.0 Significant reduction in % overweight for I1 at 16 weeks (p<0.01) and at 1 year (p<0.05) compared with I2 and I3 Mean change in weight (kg) Significant reduction in mean weight (kg) for I1 at 16 weeks (p<0.04) and at 1 year (p<0.01) compared with I2 and I3	Random allocation: Method not described Blinding: · Children: No · Providers: No · Outcome assessors: Unclear
Kirschenbaum[56] USA 1984	Overweight children (aged 9-13 years) and their parents Mean age: I1=10.4, I2=11.2, C=10.5 77% female	I1: Parent-plus child condition. Parents and children attended all sessions together. Emphasis was placed on the importance of parents and children working together (n=13) I2: Child-only condition. Only children attended group sessions (n=9) C: Waiting list control condition (n=8) Follow-up: 3 and 12 months	Weight reduction index Parents and children in groups I1 and I2 lost significantly more weight than those in group C at 9-weeks (p<0.01), 3 months (p<0.01), and at 1-year, though I1 and I2 did not differ significantly from each other at any follow-up Children in group C significantly gained weight at 3 months (p<0.05) Similar results were found for percentage overweight	Random allocation: Stratified by gender, age and initial percentage overweight Blinding: · Children: Unclear · Parents: Unclear · Outcome assessors: Unclear
Senediak[57] Australia 1985	Overweight children (aged 6-13 years) and their parents Mean age: 10.3 yrs % female: not given	I1: Rapid behavioural intervention (n=12) I2: Gradual behavioural intervention (n=12) C1: Non-specific control (n=11) C2: Waiting-list control (n=10) Follow-up: 26 weeks. I1 (n=8), I2 (n=10), C1 (n=7)	Mean percentage overweight Week 1: I1=34.63, I2=34.93, C1=41.68, C2=37.64 Week 4: I1=29.37, I2=30.70, C1=40.32, C2=39.95 Week 15: I1=20.99, I2=17.84, C1=36.72, C2=no further contact Week 26: I1=19.94, I2=16.64, C1=30.80, C2=no further contact	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear

Table 3 (continued): RCTs evaluating the effects of behaviour modification programmes

Author, country, year	Participants	Interventions, duration	Results	Comments
Graves[53] USA 1988	Obese children (aged 6-12 years) and their parents Mean age: 9.3 yrs % female: not given	Three different treatment protocols for an 8-week weight-loss programme I1: Problem-solving group (n=not given) I2: Behavioural group (n=not given) I3: Instruction only group (n=not given) Follow-up: 3 and 6 months	Children in I1 and I2 groups significantly reduced their body weights, percentages overweight, and BMIs significantly from pre- to post-treatment (p<0.05), whereas children in the I3 group did not. These differences were maintained at 3- and 6-month follow-up. The I1 group demonstrated significantly greater reductions in percentage overweight and BMI from post-treatment to 3 month follow-up (p<0.05) than I2 and I3 groups	Random allocation: Method not described Blinding: · Children: Unclear · Providers: No · Outcome assessors: Unclear
Wadden[54] USA 1990	Overweight girls (aged 12-16 years) and mothers Mean age: 13.8 years	All children attended 16 weekly, 1-hour treatment sessions following the Weight Reduction and Pride (WRAP) programme I1: Child alone (n=19) I2: Mother-child together (n=14) I3: mother-child separately (n=14) Follow-up: 6 months (n=31)	Mean BMI for all participants decreased from 35.2 at baseline, to 33.9 at 16 weeks (p<0.001). There were no differential changes among treatment conditions Mean BMI for available participants at 6-month follow-up was 35.4, which did not significantly differ from baseline	Random allocation: Stratified on the basis of BMI. Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Flodmark[58] Sweden 1993	Obese children (aged 10 to 11 years) and families Mean age: not given 52% female	I1: Family therapy as adjunct to conventional treatment (diet education by a dietician, regular visits to a paediatrician, encouraged to exercise) family therapy involved whole family 6 sessions over 12 months (n=24) I2: Conventional treatment (as above) (n=19) C: No intervention (n=50) Follow-up: 12 months	BMI (mean, SD) Baseline: I1=24.7 (0.36), I2=25.5 (0.53), C=25.1 (0.35) End of treatment (14-18 months): I1=25.0 (0.53), I2=26.1 (0.72), C=not given 12 month follow-up: I1=25.8 (0.73), I2=27.1 (0.88), C=27.9 (0.61) Significantly smaller increase in I1 than in C (p=0.02)	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Duffy[59] Australia 1993	Overweight children (aged 7-13 years) and at least one parent Mean age: 9.9 yrs 79% female	Both groups attended 8 weekly sessions of 90 min duration. Nutritional education was based on Epstein's Traffic Light System I1: Behaviour therapy plus attention placebo control (n=13) I2: Behaviour therapy plus cognitive self management (n=14) Follow-up: 3 and 6 months I1: n=10 (3 months) n =8 (6 months); I2: n=11 (3 months) n=9 (6 months)	Mean (SD) percentage overweight I1: Pre-treatment: 51.53 (26.92) Post-treatment: 42.43 (25.45) 3months: 42.84 (24.90) 6 months: 37.09 (21.71) I2: Pre-treatment: 45.48(17.52) Post-treatment: 37.70 (18.51) 3months: 38.49 (18.86) 6 months: 37.02 (24.58) Reductions from baseline statistically significant in both groups, but between group differences not significant	Random allocation: Stratified by age group (7-10 yrs and 10-13 yrs) Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Braet[60] Belgium 1997	Obese children (aged 7-16 years) and their parents Mean age: not given 63% female	Two randomised behaviour therapy groups, including seven 90 min and seven family follow-up sessions: I: Individual therapy (n=48) I2: Group therapy (n=45) Follow-up: 12 months	Percentage weight loss from baseline (%) I (3 months)=5.72 I (6 months)=8.34 I (12 months)=9.84 All significant (p<0.001) I2 (3 months)=3.31 I2 (6 months)=8.44 I2 (12 months)=13.08 All significant (p<0.001)	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Epstein[61] USA 2000a	Families with at least one child more than 20% overweight. Mean age: 10.3 yrs 52% female	I1: Problem solving taught to parent and child plus standard family based treatment targeting and reinforcing eating and exercise behaviour change (n=17*) I2: Problem solving taught to child plus standard family based treatment (n=18*) I3: Standard family based treatment (n=17*) Follow-up: 6, 12 and 24 months *10 dropouts unaccounted for	BMI Z score (mean, SD) Baseline: I1=2.8 (0.9), I2=2.6 (0.9), I3=2.7 (0.8) 6 months: I1=1.5 (0.9), I2=1.2 (0.8), I3=1.2 (0.8) 12 months: I1=1.7 (1.0), I2=1.3 (0.9), I3=1.4 (0.9) 24 months: I1=2.3 (1.1), I2=1.7 (0.9), I3=1.6 (1.0) I2 and I3 group had larger decrease in mean BMI Z score over 0-24 months (p<0.02) compared to I1	Random allocation: Families stratified by gender and degree of child and parent obesity. Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear
Goldfield[62] USA 2001	Families with obese children (aged 8-12 years) Mean age: I1=9.8 yrs, I2=10.3 yrs 71% female	I1: Mixed treatment, whereby participants received a mixture of individualised plus group treatment (n=12) I2: group treatment that did not involve individual therapy. (n=12) Follow-up: 6 and 12 months	Mean (SD) change in percentage overweight Baseline-6 months: -9.97 (8.7) Baseline-12 months: -8.04 (10.3) Mean (SD) change in Z-BMI Baseline-6 months: -0.59 (0.49) Baseline-12 months: -0.64 (0.63) Data for separate groups not given A significant reduction in percentage overweight and Z-BMI was found for both types of intervention over time (p<0.001), though there were no significant differences between interventions. I2 was found to be significantly more cost effective, due to the greater expense of I1	Random allocation: Method not described Blinding: · Children: Unclear · Providers: No · Outcome assessors: Unclear
Programmes with no parental involvement				
Warschburger[63] Germany 2001	Obese children and adolescents (aged 9-19 years) Mean age: I=13.8, C=13.1 % female: not given	In-patient rehabilitation programme I1. Group which participated in 'obesity training' (a three part programme which included a cognitive-behavioural training programme a calorie-reduced diet and an exercise program; n=121) I2. Group which undertook the same diet and exercise programmes but received muscle-relaxation training instead of the psychological intervention component (n=76) Follow-up: 6 and 12 months	Change in mean percentage overweight 6 weeks: I1=-15.47, I2=-14.03 Both groups significantly reduced their percentage overweight over the course of one year compared with baseline. Differences between the groups were not significant (p values not reported)	Random allocation: Method not described Blinding: · Children: Unclear · Providers: Unclear · Outcome assessors: Unclear

follow-up, whilst both intervention groups gained weight, there was a statistically significant increase in percentage overweight in the Weight Reduction Only group compared to the Parent Training group.

In the SHAPEDOWN programme, parents were instructed on strategies for supporting the weight-loss efforts of their children, including altering family dietary and activity patterns and improving parenting and communication skills.[50] At 15-month follow-up, participants in the intervention programme (n=37) showed statistically significant decreases in relative weight compared to a no-intervention control group (n=29).

Another RCT (n=39) evaluated the effects of targeting obese children and their parents for mastery of diet, exercise, weight loss, and parenting skills over two years.[51] A control group was taught general behaviour-change strategies. At six and 12 months follow-up, children in the intervention group had a statistically significant relative weight reduction compared to controls. These results were not maintained at two years.

The final RCT (n=60) examined the effects of parents taking responsibility for their children's behaviour change, compared to the conventional approach in which children were responsible for their own weight loss.[52] At one-year follow-up, children in both groups showed a significant decrease in obesity, although there was a statistically significantly greater reduction in the parent-led intervention group.

Family-based programmes

Ten RCTs were identified which evaluated the effects of a variety of behaviour modification programmes that involved both children and parents (and in some cases the entire family). Whilst some appear promising, given the small size of some studies and disparate nature of the interventions evaluated, there is at present insufficient evidence to recommend any specific programme.

The results of two RCTs are reported in the table only: one trial did not state how many participants were assigned to intervention arms[53]

whilst another did not report six-month follow-up results by intervention groups but by remaining participants.[54]

The first RCT (n=42) compared three methods of involving (or not involving) mothers (mother-child separately, mother-child together, and child alone) in the treatment of their obese adolescents.[55] The intervention programme consisted of behaviour modification, social support, diet and exercise. At one-year follow-up, the Mother-Child Separately group had lost significantly more weight and showed greater reductions in percentage overweight than the other two groups, which in turn did not differ from each other.

A second trial (n=40) compared behavioural treatment groups (parent plus child, child only) with a waiting list control group.[56] Children in both behavioural groups lost weight during the intervention and maintained their losses through the one-year follow-up period. No statistically significant differences were found between the behavioural treatment groups.

The third trial (n=45), compared the rapid and gradual scheduling of a behavioural programme with a non-specific control and a waiting list control group.[57] At six-month follow-up, the behavioural interventions showed significantly greater reductions in absolute weight loss and percentage overweight than the non specific control. No statistically significant differences were found between the rapid and gradual scheduling groups.

In another study, 43 children were randomised to receive either conventional treatment or family therapy as an adjunct to conventional treatment.[58] A further 50 non-randomised obese children were included in a control group that received no intervention. At 12- month follow up, the BMI scores of all three groups increased though there was a statistically significant smaller increase of BMI scores in the family therapy group than in the untreated control group. No statistically significant differences were found between the two intervention groups.

In an Australian RCT (n=27), overweight children (aged 7 to 13 years) and at least one parent, were randomly assigned to either behavioural management plus relaxation placebo or a combined behavioural-cognitive self-management approach.[59] At three- and six-month follow-up a statistically significant reduction in percentage overweight was found for children in both groups compared with baseline. There were no statistically significant differences between groups at either three- or six-month follow-up.

Another study compared four different behaviour modification programmes (summer camp training, advice in a single session, group outpatient, individual outpatient) for obese children against a control group.[60] However, the only participants who were randomised were those allocated to the two outpatient programmes (n=93). A statistically significant reduction in mean percentage overweight was found at six- and 12-month follow-up for both outpatient groups compared with baseline. However, there were no statistically significant differences between the two groups.

A six-month family-based behavioural weight control programme (n=67 families) compared parent and child problem-solving, child problem-solving and 'standard' family-based treatment (no problem-solving).[61] Over 24 months follow-up, the 'standard' group and child problem solving group showed significantly larger BMI decreases than the parent and child group.

Finally, 31 families with obese children were randomised to receive 'mixed' behavioural treatment (including individualised plus group therapy), or 'group' behavioural treatment (that did not involve individual therapy).[62] At 12-month follow-up, both interventions produced a statistically significant reduction in percentage overweight and BMI compared to baseline. However, there were no statistically significant differences between groups.

Programmes with no parental involvement

Only one RCT (n=197) was identified that involved overweight children with no parental involvement.[63] A six-week inpatient rehabilitation programme for children and adolescents (aged 9–19 years) compared a three-part cognitive-behavioural programme with a programme that provided muscle-relaxation training. Both intervention groups received the same diet and exercise programme. Both groups significantly reduced their percentage overweight over the course of one year compared with baseline. Differences between the groups were not statistically significant.

D.4. Pharmacological interventions

One RCT examined the effects of metformin on BMI, serum leptin, glucose tolerance, and serum lipids in 29 obese young people (aged 12–19 years) with fasting hyperinsulinemia and a family history of type two diabetes.[64] At the end of the six-month study a statistically significant difference (p<0.02) was found between the BMI scores for the intervention group (BMI decreased) compared with the placebo group (BMI increased).

NICE has approved the use of two drugs in the management of adult obesity, orlistat and sibutramine.[65,66] However, there is no guidance for the use of these agents in children. A US National Institute of Child Health and Human Development funded RCT concerning the use of orlistat in obese 12–17 year olds is currently ongoing.[67]

E. Implications

■ Halting the rising prevalence of childhood obesity is a public health priority. However, there is a lack of good quality evidence on the effectiveness of interventions on which to base national strategies or to inform clinical practice. Trials are often small in size, have high drop-out rates, are poorly reported and crucially involve settings that may be difficult to translate to the UK.

■ Future research must be of good methodological quality, involve large numbers of participants in appropriate settings and needs to be of longer duration and intensity. The cost effectiveness of obesity-related prevention and treatment programmes needs to be addressed.

■ There are now a number of government initiatives specifically highlighting the key role that schools can play in improving the health of children. There is some evidence that multi-faceted school-based programmes that promote physical activity, the modification of dietary intake and the targeting of sedentary behaviours may help reduce obesity in school children, particularly girls.

■ Multi-faceted family-based programmes that involve parents, increase physical activity, provide dietary education and target reductions in sedentary behaviour may help children lose weight.

■ There is some evidence that family-based behaviour modification programmes where parents take primary responsibility and act as agents of change, may help children lose weight.

Appendix on methods

Whilst based upon two Cochrane reviews,[27,28] update literature searches were also carried out for this bulletin.

Fourteen electronic databases were searched to identify both published and unpublished studies. Full details of the search strategy and databases searched are available on request.

Titles and abstracts were examined for relevance by two independent reviewers. Full papers were examined by two reviewers. Data extraction and assessment of methodological quality were undertaken by one reviewer and checked by a second reviewer. All disagreements were resolved by discussion. Data were synthesised narratively.

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Effective Health Care

This bulletin is based on systematic reviews carried out by Carolyn Summerbell, Sarah Kelly and Karen Campbell of the Cochrane Heart Group, with additional review work undertaken by staff at the NHS Centre for Reviews and Dissemination, University of York.

The bulletin was written and produced by staff at the NHS Centre for Reviews and Dissemination, University of York.

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