Downloaded from bmj.com on 24 July 2006

Evidence based paediatrics: Evidence based management of childhood obesity

Laurel Edmunds, Elizabeth Waters and Elizabeth J Elliott

BMJ 2001;323;916-919
doi:10.1136/bmj.323.7318.916

Updated information and services can be found at:
http://bmj.com/cgi/content/full/323/7318/916

These include:

References

This article cites 19 articles, 10 of which can be accessed free at:
http://bmj.com/cgi/content/full/323/7318/916#BIBL

4 online articles that cite this article can be accessed at:
http://bmj.com/cgi/content/full/323/7318/916#otherarticles

Rapid responses

5 rapid responses have been posted to this article, which you can access for free at:
http://bmj.com/cgi/content/full/323/7318/916#responses

You can respond to this article at:
http://bmj.com/cgi/eletter-submit/323/7318/916

Email alerting service

Receive free email alerts when new articles cite this article - sign up in the box at the top right corner of the article

Topic collections

Articles on similar topics can be found in the following collections

Systematic reviews (incl meta-analyses): descriptions (131 articles)
Guidelines (447 articles)
Other evidence based practice (459 articles)
Other Pediatrics (1814 articles)

Notes

To order reprints of this article go to:
http://www.bmjjournals.com/cgi/reprintform

To subscribe to *BMJ* go to:
http://bmj.bmjjournals.com/subscriptions/subscribe.shtml

Downloaded from bmj.com on 24 July 2006

Evidence based paediatrics

Evidence based management of childhood obesity

Laurel Edmunds, Elizabeth Waters, Elizabeth J Elliott

This is the second in a series of five articles

Department of Public Health, University of Oxford, Oxford OX3 7LF, UK
Laurel Edmunds *research fellow*

Centre for Community Child Health, Royal Children's Hospital, University of Melbourne, Parkville, Vic 3052, Australia
Elizabeth Waters *director, research and public health*

University of Sydney and New Children's Hospital, Sydney, 2145 NSW, Australia
Elizabeth J Elliott *associate professor of paediatrics and epidemiology*

Correspondence to: Laurel Edmunds laurel.edmunds@dphpc.ox.ac.uk

Series editor: Virginia A Moyer Virginia.A.Moyer@uth.tmc.edu

BMJ 2001;323:916–9

THE CASE The parents of a 10 year old boy who is very overweight bring him to consult you. He is an only child. His mother is of normal weight but his father is a large man and is overweight. His father's two brothers are obese. His parents report that the boy's behaviour is deteriorating and that he is becoming isolated from his peers. His mother has tried various dieting strategies but these have not halted his increasing gain in weight. His parents are concerned that he will "end up like his two uncles." The boy says he is unhappy about his size because he gets teased and has trouble making friends. His mother asks whether his health is at risk and how he can be helped.

Background

In 1998 the World Health Organization designated obesity as a global epidemic.[1] The epidemic, which includes adults and children, is a result of societal and environmental factors that promote weight gain, factors that health professionals cannot expect to change. Results of obesity treatment programmes at obesity clinics have been disappointing, although children do better than adults. Prevention is therefore essential to reduce the health burden of obesity on society. It is vital to treat and prevent obesity in childhood, as lifestyle behaviours that contribute to and sustain obesity in adults are less well established in children and may be more amenable to change. The evidence suggests that the family provides a suitable environment for treatment and prevention of further weight gain, and schools present a convenient opportunity for population based prevention strategies, as long as overweight children are not stigmatised.

Evaluating weight status in children is a problem. Body status is frequently described in terms of the body mass index (body mass index = weight (kg)/height (m)^2). The index increases after birth, decreases around the age of 2 years, and increases again between the ages of 5 and 8. This second increase is termed the period of "adiposity rebound," considered early if it occurs at 5-6 years. Body mass index cut off points are the same as in adults, a value above 25 indicating overweight and above 30 indicating obesity.[2 3] This is not a perfect measure in children, because children accumulate fat free mass as they grow, but it does correlate moderately well to strongly with estimates of "fatness." Use of population specific centiles of the body mass index, where available, has been suggested. "Overweight" and "obese" are usually defined as values above the 85th and 95th percentiles, respectively.

Database queries

You need the evidence based answers to a number of questions before you can decide on the best course of action for your patient. You frame your questions to elicit the evidence, specifying in each case the population; the event or exposure; the intervention; and the outcome; and identifying the question type—whether it seeks evidence of a prevalence or risk in a baseline population, a prognosis, the value of therapy.

(1) In 6-12 year old children (population) what is the prevalence (event) of overweight or obesity (outcome)? [baseline risk]
(2) In children who are overweight or obese (population, exposure) what is the risk of psychosocial problems (outcome)? [baseline risk]
(3) In children who are overweight or obese (population, exposure) what is the risk of current and future health problems (outcome)? [baseline risk, prognosis]
(4) In children who are overweight or obese (population, exposure) what is the risk of obesity in adulthood (outcome)? [prognosis]
(5) In obese pre-adolescent children (population, exposure) are family based programmes (intervention) effective for weight reduction (outcome)? [therapy]
(6) In children (population) do school based programmes (intervention) effectively prevent and treat overweight and obesity without risk of harm (outcome)? [therapy]

You start your search with sources of summarised and appraised evidence. Clinical Evidence (Issue 5, 2001) has no chapter on childhood obesity. The *Cochrane Library*, an electronic source of high quality reviews of effective interventions (www.update-software.com/clibhome/clib.htm (password required)), contains one review and one protocol for a review of childhood obesity, entitled "Interventions for preventing obesity in childhood"[4] and "Interventions for treating obesity in childhood."[5] Two additional reviews of randomised controlled trials are located in the database of abstracts of reviews of effectiveness (DARE),[6 7] and two recent trials of obesity treatment

Summary points

- Young obese children should maintain weight or gain weight slowly rather than lose weight
- Inculcating healthy eating habits is better than restricting diet
- Sustainable lifestyle activities should be encouraged
- Psychosocial problems are important consequences of overweight or obesity
- Behavioural treatments should be individually designed
- All treatments must be acceptable to the family

Downloaded from bmj.com on 24 July 2006

are listed in the Cochrane controlled trials register (CCTR).[8 9] Additionally, the internet site of the journal *Pediatrics* provides recommendations for the evaluation and treatment of overweight children (posted in 1998).[10] These sources of high quality evidence provide the information you need without the need for a detailed search of Medline.

Summary of evidence

Prevalence of overweight and obesity

Evidence from the national health and nutrition examination survey (NHANES) in the United States and the national study of health and growth in the United Kingdom shows an increasing prevalence of overweight and obesity in young children and adolescents.[11 12] The distribution curve of overweight has become skewed to the right over time, indicating that children who are already overweight are getting fatter. In the United States, the proportion of 6 to 11 year old children who are obese (body mass index above the 95th centile) has increased from 3.9% to 11.4% for boys and 4.3% to 9.9% for girls between surveys in 1963-5 and 1988-9. In the United Kingdom, the findings of the national study indicate general increases in children's weight and skinfold thickness across the whole population.

Psychological problems

Evidence from experimental and longitudinal cohort studies shows that overweight children are likely to suffer from psychological problems. It has been observed that by six years old children have picked up societal messages that overweight is undesirable, and overweight children may encounter rejection and become socially isolated, or they may develop a distorted body image. Recent research has shown poorer outcomes for overweight and obese boys than for girls.[13] The social burden of obesity affects educational attainment and interpersonal relationships.[14] Obese children have an increased risk of psychosocial and psychological problems that can persist into adulthood.

Current and future health problems

Persistent obesity in childhood is associated with other lifestyle related diseases that may persist in adulthood. These include cardiovascular diseases, non-insulin dependent diabetes mellitus (now occurring in children), osteoarthritis, breast and alimentary cancers, skin disorders, aggravation of rheumatic diseases, and asthma and other respiratory diseases.[15] Childhood obesity increases the risk of childhood hyperinsulinaemia, hypertension, and dyslipidaemia. Odds ratios for these findings in obese children were 2.4 for raised diastolic blood pressure, 3.0 for raised low density lipoprotein fraction of cholesterol, 3.4 for raised high density fraction, 4.5 for raised systolic blood pressure, 7.1 for raised triglycerides, and 12.6 for low fasting insulin. Two or more risk factors were present in 58% of obese children.[16]

Risk of obesity in adulthood

Overweight children are twice as likely as normal children to be obese as adults.[17] Evidence from a systematic review of risk factors for obesity[18] and two birth cohort studies[17 19] showed that children with overweight or obese parents have a higher risk of obesity—79% of 10-14 year old children with at least one obese parent were obese—regardless of whether the parental obesity is of genetic or environmental origin. However, identifying children at risk of persistent obesity is an inexact science. Current body status, having an obese parent, and early occurrence of the adiposity rebound (at around 5 years) may predict obesity in adulthood.[20] These findings are important as they show that progression from childhood to adult obesity is not inevitable and intervention may be effective.

Family based programmes for weight reduction

The earlier the intervention the better, and much research has therefore focused on children aged 5-12.[6–21] The results of relevant clinical trials are summarised in reviews of the literature.[6 7 22] In most of these trials the children were followed up for about a year (range 0-10 years). Each review documents the importance of diet, activity, and behaviour change as components of management of obesity. One review also considered the benefits of treatment on metabolic variables and psychological wellbeing.[7] Several different dietary approaches successfully reduced calorie intake and improved eating behaviour. The addition of activity (both supervised and unsupervised) improves long term chances of weight control.[6 7] The following are findings from randomised controlled trials included in these reviews.[6 7]

Diet—A balanced reduced calorie diet (focusing on eating fewer energy dense foods) given in line with dietary guidelines—for example, Epstein's "traffic light" diet, which divides foods into "coloured" groups according to whether they can be consumed freely (green), with discretion (yellow), or should be strictly limited)—was more effective than no diet. Trials of hypocaloric diets, protein modified fasts, fibre supplementation and prescription of the anorectic agent fenfluramine were all ineffective in reducing weight.

Physical activity—One study with a 10 year follow up found diet plus encouragement of healthy physical activities was more effective over time than either diet with aerobic exercises or diet with calisthenics. Another study showed that reinforcing a decrease in sedentary behaviour resulted in greater weight loss than reinforcing an increase in activity or reinforcing both behaviours—for example, encouraging children to watch less television is more effective than encouraging them to participate in sports. Three studies showed exercise was more effective than no exercise.

Behaviour modification—Two trials found that behaviour modification was effective, and a third found greater effects with behaviour modification than with education alone.

Parental effects—Individual studies found that parents are better agents of change than children; parental training and family therapy were effective; and treating parents and children together can be better than treating children on their own.

This evidence indicates that emphasis should be placed on individualising behavioural treatments for obesity. Even parents who are themselves intractably obese have an important role in supporting children up to age 8.[22] The circumstances in which the intervention is delivered and by whom may be as important as its content.[23] Some treatment strategies seem to be working but there is no clear consistency in

Downloaded from bmj.com on 24 July 2006

Summary of evidence

Question	Type of evidence	Result	Comment
What is the prevalence of childhood obesity?	National surveys for children <12 years	Evidence shows an increasing prevalence of overweight and obesity	Increasing trend in industrialised countries, seen more recently in developing countries
Are overweight or obese children at increased risk of psychosocial problems?	Cross sectional and longitudinal cohort studies	Overweight or obesity has a detrimental effect on psychological wellbeing in childhood	Psychological effects may persist into adulthood
Are overweight or obese children at increased risk of current and future health problems?	Cross sectional studies	Childhood obesity results in detrimental lipid profiles and increases risk for future obesity, metabolic syndrome, CVD and non-insulin dependent diabetes mellitus	Negative medical consequences of overweight have an impact on health outcomes in adulthood
Do overweight or obese children become overweight adults?	Birth cohort studies and systematic review of risk factors	Children with body mass index >85th centile, an obese parent, and an adiposity rebound at about 5 years are at risk of being persistently overweight	These indicators are useful for identification purposes
Are family based programmes effective for weight reduction in children?	Family based RCTs	Effective components: improving diet and dietary behaviours; increasing lifestyle physical activity; decreasing sedentary behaviours; family support	Treatment effects are limited but more successful in children than in their parents; more research is required to establish effective strategies
Are school based programmes effective for prevention and treatment of overweight and obesity?	School based RCTs on interventions to prevent obesity and cardiovascular disease	Obesity prevention studies have positive effect, CVD prevention studies have mixed results; treatment studies have some positive effects	Decreasing sedentary pastimes and improving diet at school seem promising for prevention. Schools are not suitable locations for treatment due to stigmatisation of children receiving treatment

RCT=randomised controlled trial; CVD=cardiovascular disease.

effectiveness. The observed effects on loss of weight or of fat are modest, suggesting that overweight and obesity are resistant to treatment, partly because to have any effect interventions need to be complex, partly because such interventions do not alter the context of the obese child's environment external to the family. Environmental, psychological, and sociodemographic factors tend to be ignored.[6]

A recent expert committee's review of ways of preventing and treating childhood obesity, including diet and physical activity, provides an informative background to the use of family therapy and improving parenting skills for weight management.[10] Its general recommendations include the following.

- Clinicians need to know that obesity may be endogenous (genetic or endocrine) and they need to be aware of its complications in children
- The primary goal of treatment is healthy eating and inculcating good habits of physical activity
- Parents who believe that obesity is inevitable or are not ready to make changes within the family may need counselling to make them more willing to cooperate
- Treatment of overweight or obesity should begin early and involve the family
- The aim should be for small, incremental changes in behaviour, with recognition of the need for ongoing support for families.

School based programmes for preventing and treating obesity

Schoolteachers are in daily contact with children during term time for at least 11 years, and school nurses, for example, are well placed to spot the overweight child at an early stage and to help to prevent obesity developing. Schools provide a safe environment, a curriculum programme, can ensure that school lunches are healthy, and have facilities for physical activities supervised by trained staff. School based prevention interventions that are integrated into the normal curriculum or school health promotion activities, with the aim of reducing risk factors for cardiovascular disease, show promise.[24] Typically, these interventions involve a multifaceted approach to the whole child that includes diet, physical activity, and other educational and psychological components. Efforts which emphasise activity and building of self esteem may minimise concerns about inadvertently giving rise to eating disorders.

Current evidence relating to the management of obesity in children is summarised in the table. From this, you can prepare a well supported management plan for your patient and his family.

Applying the evidence

You show your patient where he fits on the growth and body mass index percentile charts and you discuss the principles of management of overweight with the child and his parents. You teach the family about healthy eating habits (following dietary guidelines) that are sustainable throughout life but explain that dietary restriction in childhood may interfere with normal growth and development. Because the boy has not reached puberty and should still be growing, you encourage him to slow his rate of weight increase or maintain his weight, rather than to lose weight, so that he "grows into his weight." (After puberty, you would have recommended him to lose weight at 0.5-1 kg per week.)

You explain that "lifestyle activities" such as walking and cycling—activities that are sustainable throughout life—are more effective for weight control than other forms of exercise, and you devise a programme for this boy. Because more vigorous activities expose a child's overweight, you choose activities that will be enjoyable and will not make him look ridiculous or embarrass him. You explain that increased physical activity will benefit long term weight management and psychological and emotional wellbeing and will protect against diseases associated with obesity.

You acknowledge that for the child the psychosocial consequences of obesity are the most important. You offer some strategies to help him cope with the teasing or bullying he is experiencing at school and to improve his self esteem.[25] You ask the parents' permission to discuss these with the school. Because the family's patterns of eating and exercise are well established and the child's excess weight may have a genetic component, you devise a behavioural treatment programme that is individualised for the child and acceptable to the family. You explain to the parents that counselling and further education and instruction in parenting skills may be useful to help them facilitate behaviour change in this child.

Competing interests: None declared.

Downloaded from bmj.com on 24 July 2006

1 World Health Organization. *Obesity: preventing and managing the global epidemic.* Geneva: WHO, 1998.
2 Dietz WH, Bellizzi M. Workshop on childhood obesity: summary of the discussion. *Am J Clin Nutr* 1999;70:S126-30.
3 Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000;320;1240-3.
4 Campbell K, Waters E, O'Meara S, Summerbell C. Interventions for preventing obesity in children (Cochrane review). Cochrane Database Syst Rev. 2001;1:CD001871.
5 Summerbell C, Waters E, Edmunds L, O'Meara S, Campbell K. Interventions for treating obesity in childhood (Protocol for a Cochrane review). *Cochrane Library*, Issue 2, 2001. Oxford: Update Software.
6 Glenny A-M, O'Meara S. *Systematic review of interventions in the treatment and prevention of obesity.* NHS Centre for Reviews and Dissemination, University of York. York: York Publishing Services, 1997.
7 Epstein LH, Myers MD, Raynor HA, Saelens BE. Treatment of pediatric obesity. *Pediatrics* 1998;101:554-70.
8 Owens S, Gutin B, Allision J, Riggs S, Ferguson M, Litaker M, et al. Effect of physical training on total and visceral fat in obese children. *Med Sci Sports Exerc* 1999; 31:143-8.
9 Golan M, Fainaru M, Weizman A. Role of behaviour modification in the treatment of childhood obesity with parents as the exclusive agents of change. *Int J Obes* 1998;22:1217-24.
10 Barlow SE, Dietz WH. Obesity evaluation and treatment: expert committee recommendations. *Pediatrics* 1998;102:E29 (www.pediatrics.org/cgi/content/full/102/3/e29).
11 Flegal KM. The obesity epidemic in children and adults: current evidence and research issues. *Med Sci Sports Exerc* 1999; 31:S509-14.
12 Hughes JM, Li L, Chinn S, Rona RJ. Trends in growth in England and Scotland, 1972 to 1994. *Arch Dis Child* 1997;76:182-9.
13 Wake M, Salmon L, Waters E. Health status of overweight/obese and underweight children: a population based survey. Supplement to *Pediatric Research* 2000;47(part 2):A943.
14 Gortmaker SL, Must A, Perrin JM, Sobol AM, Dietz WH. Social and economic consequences of overweight in adolescence and young adulthood. *N Engl J Med* 1993;329:1008-12.
15 Black D. Obesity: a report of the Royal College of Physicians. *J R Col Physicians* 1983;17:5-64.
16 Freedman DS, Dietz WH, Srinavisian SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa heart study. *Pediatrics* 1999;103:1175-82.
17 Whitaker RC, Wright JA, Pepe S, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med* 1997;337:869-73.
18 Parsons TJ, Power C, Logan S, Summerbell CD. Childhood predictors of adult obesity. *Int J Obes* 1999;23(Suppl 8):S1-107.
19 Lake JK, Power C, Cole TJ. Child to adult body mass index in 1958 British birth cohort: associations with parental obesity. *Arch Dis Child* 1997;77:376-81.
20 Whitaker RC, Pepe- S, Wright A, Seidel KD, Dietz WH. Early adiposity rebound and the risk of adult obesity. *Pediatrics* 1998;101:E5.
21 Haddock CK, Shadish WR, Klesges RC, Stein RJ. Treatments for childhood and adolescent obesity. *Ann Behav Med* 1994;16:235-44.
22 Gill TP. Key issues in the prevention of obesity. *Br Med Bull* 1997;53: 359-88.
23 Biddle SJH, Fox KR, Edmunds L. *Physical activity promotion in primary health care in England.* London: Health Education Authority, 1994.
24 Story M. School-based approaches for preventing and treating obesity. *Int J Obes* 1999;23(Suppl 2):S43-51.
25 French SA, Story M, Perry CL. Self-esteem and obesity in children and adolescents: A literature review. *Obes Res* 1995;3:479-90.

Evidence Based Pediatrics and Child Health can be purchased through the BMJ Bookshop (www.bmjbookshop.com); further information and updates for the book are available on www.evidbased pediatrics.com

HOW DOES IT WORK?

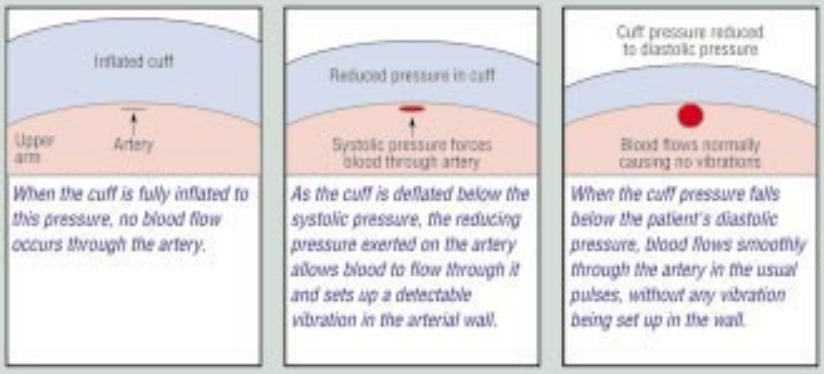
Oscillatory blood pressure monitoring devices

Pressure against using mercury in clinical practice is coming from environmentalists, and, in line with other countries in Europe, mercury column devices for measuring blood pressure are likely to be stopped being manufactured soon in Britain.

Aneroid (or clock face) devices which also depend on auscultation are gaining popularity, as are devices which depend on oscillation.

Oscillatory devices produce a digital readout and work on the principle that blood flowing through an artery between systolic and diastolic pressures causes vibrations in the arterial wall which can be detected and transduced into electrical signals.

With an oscillatory device, a cuff is inflated over the upper arm or wrist. The new models use "fuzzy logic" to decide how much the cuff should be inflated to reach a pressure about 20 mm Hg above systolic pressure for any individual. When the cuff is fully inflated to this pressure, no blood flow occurs through the artery. As the cuff is deflated below the systolic pressure, the reducing pressure exerted on the artery allows blood to flow through it and sets up a detectable vibration in the arterial wall. When the cuff pressure falls below the patient's diastolic pressure, blood flows smoothly through the artery in the usual pulses, without any vibration being set up in the wall.



When the cuff is fully inflated to this pressure, no blood flow occurs through the artery.

As the cuff is deflated below the systolic pressure, the reducing pressure exerted on the artery allows blood to flow through it and sets up a detectable vibration in the arterial wall.

When the cuff pressure falls below the patient's diastolic pressure, blood flows smoothly through the artery in the usual pulses, without any vibration being set up in the wall.

Vibrations occur at any point where the cuff pressure is sufficiently high that the blood has to push the arterial wall open in order to flow through the artery.

The vibrations are transferred from the arterial wall, through the air inside the cuff, into a transducer in the monitor that converts the measurements into electrical signals.

These digital devices deflate at about 4 mm Hg per second, making them sometimes seem slower to use than auscultatory aneroid devices, but they are more accurate.

Arrhythmias introduce additional vibrations within the arterial wall, presenting problems for detecting blood pressure regardless of the technique employed. Elderly people have less elastic arteries, but even the weakest vibrations are detectable using oscillometric devices and the correct sized cuff. Bladders within upper arm cuffs must encircle 80% of the arm's circumference.

Abi Berger, *science editor, BMJ*