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Prevention of childhood obesity

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Childhood obesity is a complex disease with different genetic, metabolic, environmental and behavioural components that are interrelated and potentially confounding, thus making causal pathways difficult to define. Given the tracking of obesity and the associated risk factors, childhood is an important period for prevention. To date, evidence would support preventative interventions that encourage physical activity and a healthy diet, restrict sedentary activities and offer behavioural support. However, these interventions should involve not only the child but the whole family, school and community. If the current global obesity epidemic is to be halted, further large-scale, well-designed prevention studies are required, particularly within settings outside of the USA, in order to expand the currently limited evidence base upon which clinical recommendations and public health approaches can be formulated. This must be accompanied by enhanced monitoring of paediatric obesity prevalence and continued support from all stakeholders at global, national, regional and local levels.

Key words: childhood; obesity prevention; physical activity; healthy diet; sedentary behaviour; ante/postnatal; body mass index; waist circumference; school; community; government.

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The preceding chapters have described the epidemiology, the potential causes, and the documented and projected physical, psychological and social impacts of the obesity epidemic engulfing us. Consistent with epidemics throughout history there has been a pervading sense of disbelief at the rapidity of change, a grappling with how to halt its spread, and—perhaps inevitably—a prolonged period of substantial inaction. The individual nature of both the genetic and behavioural determinants of obesity, coupled with the pervading belief that obesity development reflects the individual's imprudent behaviour, has promoted the belief at a population level that the prevention of this epidemic was the purvey of the individuals concerned. However, as demonstrated in the previous chapters, obesity prevention has eluded us, and the obesity epidemic will affect us all. We are challenged to consider obesity prevention in its broadest context.

Obesity genesis is complex and prevention is not simple.[1,2] It is acknowledged that the treatment of childhood obesity is expensive and unlikely—at a population level—to be successful[3], that obesity tracks strongly to adulthood[4,5], and that, irrespective of adult weight, adolescent overweight predicts a broad range of adverse health effects.[6] Further, we recognize that many obesity-promoting behaviours are learnt in childhood and may track to adulthood.[7–9] Given the insidious consequences of childhood obesity, understanding how best to prevent it remains the principal research priority. Indeed, a recent review of obesity in children and young people[10] concluded that obesity prevention is 'the only feasible solution for developed and developing countries alike'. This chapter discusses the opportunities, challenges and barriers to obesity prevention in an environment that actively supports the promotion of fatness.

TARGET GROUPS

When developing and implementing childhood obesity prevention interventions, should we target the population as a whole or focus specifically on those children 'at risk'? Power et al[11] strongly advocated the population approach on the basis that it is extremely difficult to confidently identify all children at risk of developing obesity. It is also true to argue that interventions to promote a healthy diet and increased physical activity will benefit all children, irrespective of obesity risk. Certainly from a public health angle this population-based approach is undoubtedly preferable; however, this should not eliminate the use of more tailored interventions in groups with established risks.

Contrary to a popular misconception, fewer than 1% of childhood obesity cases are directly caused by a genetic disorder. Although genetics are undeniably important in obesity genesis, they form part of a complex interaction with many other environmental and behavioural factors, as illustrated by Bray[12] who commented that a child's genetic make-up 'loads the gun' while their environment 'pulls the trigger'. Parsons et al[5] performed a systematic review to identify risk factors for obesity. The review concluded that parental fatness, social factors, birth weight, timing or rate of maturation, physical activity, dietary, and other behavioural or psychological factors all contributed to the onset of obesity. It has also been established that ethnicity and social and economic deprivation[13] are important determinants of obesity development, as are special educational needs in children whose physical or learning disability may predispose obesity onset. However, the systematic review and meta-analytic literature on the management of obesity[14] highlights the absence of evidence regarding

the efficacy of interventions targeting specific socio-economic, ethnic or vulnerable childhood groups.

Practice points

- potentially, all children are at risk of developing obesity
- every child could benefit from interventions that promote a healthy diet and increased physical activity
- special educational needs, ethnicity and socio-economic deprivation can all increase the risk of developing childhood obesity

Research agenda

- the efficacy of interventions targeting the prevention of childhood obesity in specific socio-economic, ethnic and vulnerable groups should be investigated

PREVENTATIVE INTERVENTIONS

Paediatric obesity prevention programmes must be placed in the context of nutritional adequacy to protect proper growth and development over time and acknowledge the risk of producing adverse effects, particularly relating to psychological health. However, studies that have included adverse outcome measures—such as psychological health or growth retardation—have generally failed to find evidence of adversity.[15–18] Providing that all preventative interventions are implemented sensitively, they should not exacerbate existing stigmatization of obese children or increase health risks for non-obese children. However, every intervention should factor all eventualities, where possible.[19]

Preventing paediatric obesity is likely to be the only way in which the current obesity epidemic will be contained, yet the evidence regarding how best to do this still remains weak. Lister-Sharp et al[20] in the UK and Micucci et al[21] in Canada performed a review of systematic reviews which focused upon school-based prevention strategies. A more general review of systematic reviews by Mulvihill and Quigley[14] identified four that investigated the prevention of paediatric obesity and overweight.[1,22–24]

The Cochrane review[1] on the prevention of childhood obesity examined seven studies: randomized control trials (RCTs) and non-randomized trials with concurrent control group, three long-term and four short-term. However, the majority of these studies were performed using small sample sizes of children aged 7–12 years in the USA. The authors concluded that a simple reduction in sedentary behaviour provided the most promising intervention (the results identified from two studies in US school children), although there is an urgent requirement for further well-designed studies in this area. Due to the limited available data, the authors found it difficult to conclude whether one strategy or a combination of strategies was more important for obesity prevention. They concluded that 'currently there is limited quality data on the effectiveness of obesity prevention programmes and as such no generalizable

conclusion can be drawn. The mismatch between the prevalence and significance of the condition and the knowledge base from which to inform preventative activity is remarkable and an outstanding feature of this review.'

School-based interventions

Schools influence the lives of most children and should therefore provide an ideal platform for the education and promotion of healthy diets, physical activity and other healthy behaviours. The reviews by Lister-Sharp et al[20] and Micucci et al[21], which focused upon school-based interventions, both concluded that multi-component interventions can be effective in modifying obesity, physical activity and nutrition, although the results identified were not consistent. The systematic review by the National Health Service Centre for Reviews and Dissemination (NHS CRD, 2002)[24] highlighted eight school-based prevention interventions: one health promotion programme, two physical activity programmes and five multifaceted interventions. The health promotion RCT[25] used a classroom curriculum to reduce television, videotape and video game use among children aged 8–9 years. After a 7-month follow-up, the children in the intervention group watched significantly less television, videos and computer games when compared to the control group. This was complemented with a significant reduction in body mass index (BMI), waist circumference, waist-to-hip ratio and tricep skin-fold thickness in the intervention group, although there was no difference in the consumption of high-fat foods. The links between television viewing and childhood obesity was recently reviewed by Caroli et al.[26] This review concluded that television viewing correlated with obesity prevalence due to a possible combination of increased sedentary activity and the influence of unhealthy programming and advertisement stimuli. The multifaceted interventions identified contained nutrition, education, physical activity, reduced sedentary behaviour, behavioural therapy, teacher training, curricular material and modification of school catering components. The review concluded that this multifaceted approach 'may help to reduce obesity in school children, particularly girls'. The two physical activity programmes—one in kindergarten-aged children[27] and one in primary-school-aged children[28]—resulted in no significant difference in the levels of obesity between the exercise and control groups. Similar outcomes were also reported in the more recent systematic review by Reilly and McDowell[29] However, there remains a lack of good quality evidence on the effectiveness of both physical activity interventions, particularly within research settings outside of the USA. Indeed, there is also a similar deficit in good-quality school-based dietary interventions, and although evidence is emerging around the association between obesity and consumption of sugar-sweetened drinks[30,31], further work is urgently required.

Given the numerous government initiatives specifically highlighting the key role of schools in improving child health, it is imperative that further high-quality research is implemented to enhance the current evidence base, guide future policy-making, and optimize outcome. Story[32] suggested that 'while multifaceted community-wide efforts are needed to address the growing problem of obesity, schools are in a unique position to play a pivotal role in promoting healthy lifestyles and helping to prevent obesity'. As discussed later in the text, this has implications for all professionals associated with school environments.

Practice point

- there is some evidence to support the use of multifaceted school-based interventions to reduce childhood obesity, particularly in girls

Research agenda

- currently, there is a lack of consistent evidence to support school-based health promotion, reduced sedentary behaviour, increased physical activity and dietary interventions for the prevention of obesity and overweight in children
- further research is required to determine the full impact of sugar-sweetened drink consumption and childhood obesity prevalence
- more longer-term, well-designed studies are required, particularly in research settings outside of the USA

Individual and family-based interventions

The consideration of the broader influences on a child's obesity-promoting behaviours has been reinforced by Davison and Birch's[33] use of ecological systems theory[34] to explain the contributions of child-specific characteristics, the family environment and community characteristics to the development of obesity among children.

Applying such theory to the understanding of opportunities for influencing children's diet and activity moves us away from a consideration of eating, activity and sedentary behaviours per se to one of the relative importance of multiple potential precursors of these behaviours. For example, literature suggests that children's obesity-promoting dietary behaviours are affected by opportunities to share family meals[35], by the amount and timing of television exposure[36,37], by a parent's child-feeding practices[38], by a mother's knowledge of nutrition[39,40], by a child's exposure to food[41], and by parental role-modelling.[39,42,43] In addition, factors external to the family—such as the availability and accessibility of fruits and vegetables, and access to food shops—may impact on a child's food intake.

The interface between personal responsibility for eating, activity and sedentary behaviours, and the environments within which individuals, parents and children make dietary and activity choices must also be considered. By way of example, a parent may buy and prepare an excellent range of highly nutritious foods, model-eating these and encourage their child to eat them, thereby taking high levels of personal responsibility for their child's diet. However, it is likely that this will occur within an environment in which the child is constantly confronted by images and promotions of low-cost, energy-dense foods. Indeed, it is likely that such foods will be actively marketed during school hours via TV-based educational programming[44], sports sponsorship, exclusive food and beverage marketing contracts (Nestle 2002), and via industry-sponsored educational materials. It is also likely that energy-dense foods will be promoted and offered for sale during school breaks[45], and that such foods may be used as rewards for good work or behaviour at school. Parenting clearly occurs within a complex, often contradictory and commercially aggressive environment in which personal responsibilities taken by

parents may be swamped by broader environmental forces. Obesity prevention is more likely to be effective if government policy and community structures support efforts undertaken by parents.

In 2002, a range of studies was evaluated by the NHS CRD[24] to examine the efficacy of family-based health promotion and behaviour modification programmes for obesity prevention. The two RCTs with a predominant focus on dietary/general health education and increased activity[16,46] involved continued contact with children and parents; although dietary habits were influenced, there was no significant impact on weight. The analysis of family-based behaviour modification programmes were subdivided to assess parents as agents of change and family behaviour modification programmes. While studies concentrated on overweight and obese children, they demonstrated that interventions that focus upon parents as the 'agents of change' could help children to reduce weight. However, once again the evidence base is weak and would benefit from further well-structured intervention studies that examine the broader possibilities of family-based prevention strategies.

Practice points

- families provide the microenvironments within which children learn and enact health behaviours
- parents' efforts to provide an environment that will promote healthy weight are likely to be undermined by the broader environment in which they function
- there is limited evidence to demonstrate the benefit of family-based health promotion interventions for obesity prevention
- there is some evidence to show that family-based interventions that focus upon parents as the 'agents of change' can help prevent obesity in overweight children

Research agenda

- more research is required to evaluate the full benefit of family-based obesity prevention programmes, with particular focus upon multifaceted approaches that embrace parents as the 'agents of change'

Preschool and antenatal/postnatal interventions

Whilst much research has focused upon school-aged children, similar efforts in preschool children are lacking. Indeed, research in the preschool population presents a priority, with the concerning increases in the prevalence of preschool childhood obesity. Appropriate preventative interventions within this paediatric population would help reduce early-onset obesity and establish favourable dietary, physical activity, and behavioural patterns during this most receptive time of life. Existing RCT studies are predominantly from the USA and include the Healthy Start Project[47,48], which demonstrated significant improvements to cardiovascular risk following the implementation of the preschool food service intervention, the 5-year Hip-Hop to Health Jr[49] (results pending), and Nutrition Education Aimed at Toddlers (NEAT) project[50] which showed no significant effect of a family-orientated nutritional intervention.

Given the growing evidence base around the importance of the ante/postnatal period in obesity development, should obesity prevention begin during the antenatal period? A large study by Whitaker et al[51] demonstrated that maternal weight is significantly correlated to preschool obesity prevalence.[51] There is also mounting evidence to support a small but consistent protective effect of breast-feeding, as demonstrated in a systematic review by Arenz et al.[52] It is also possible that postnatal weight is implicated in obesity development, with several studies reporting the correlation between rapid early weight gain and increased risk of obesity.[53–55] It is therefore possible that the ante/postnatal period may provide an important opportunity for obesity prevention by affecting obesity-promoting genetics and environmental and behavioural stimuli that are persisting in intergenerational cycles. This area of research would benefit greatly from further large, well-designed RCT programmes in order to expand the current evidence base upon which any clinical recommendations can be formulated.

Practice points

- maternal weight, rapid early weight gain and breast-feeding are all significantly associated with preschool childhood obesity patterns
- although it would seem logical that the early preschool years are a good time to conduct obesity prevention programmes, there has been little research in this area

Research agenda

- further large, well-designed studies are required to assess the efficacy of obesity prevention programmes during the antenatal and preschool years

THE ROLE OF THE HEALTH PROFESSIONALS AND SERVICE PROVIDERS

Eating, activity and sedentary behaviours that promote obesity are learnt in childhood. Given the significance of these early years it is reasonable to suggest that parents need to be actively supported in their efforts to achieve health-promoting environments for their children. Health professionals and service providers have unique access to parents of young children. As such these groups have unmatched opportunities to inform and influence parents regarding all aspects of obesity prevention.

At the most basic level, parents might receive 'anticipatory guidance'[56], whereby obesity prevention messages align with a child's development. For example, early contacts with a paediatric nurse might focus on appropriate foods and fluids for weaning and on feeding styles, while preschool educators might teach parents about methods by which to limit television viewing and its impact on requests for energy-dense foods, on ways in which to promote fruit and vegetable consumption, and on practical management of feeding fussiness. It seems plausible that the delivery of consistent messages from respected figures throughout a child's development will provide a powerful tool for the shaping of obesity prevention strategies. These of course must be viewed in the context

of a broader environment which ensures that health and education practitioners are well trained and supported to provide reliable advice.

It is also important that practitioners are trained to think beyond the confines of their practice and consider the broader environments in which their clients live. The strong ownership by Australian teachers of the skin cancer prevention strategy, 'No Hat, No Play'[57], provides an excellent example of the ways in which parents' efforts to protect their children from sun damage and resultant skin cancers are strengthened, and further provides a model which parents might adopt for themselves and their children at home. Similar models could feasibly be extended to obesity prevention strategies in schools, with teachers and/or school nurses taking a lead role as champions for comprehensive, whole-school approaches. Health education in the class may then be supported by opportunities in the canteen and playground, indeed in the broader school community. This might include school pricing incentives that favour low- over high-energy density foods[45], the active promotion of these foods to students[58], school nutrition policies that promote the use of non-food rewards[59], and the growing of foods[60], and that prohibit food advertising or sponsorship at schools (e.g. TV-based educational programming).[44] This might also include the manipulation of school playgrounds to promote physical activity[61], and the promotion of active commuting to schools (e.g. mapping of safe routes to school, walk/bike-to-school days, walking school buses, bike trains).[62] The opportunity to maximize the use of school play areas would also be supported by policies that encourage the use of these community facilities out of school hours.

Further, with increased knowledge and awareness of the implications of childhood obesity, health professionals and service providers have the capacity to expand the public's understanding of and interest in this issue. In so doing, the capacity to advocate and agitate for obesity prevention efforts at the broader political level will increase. The dissent in the US regarding the marketing and sales of soft drinks in schools, and the subsequent changes in legislation to prevent this, provides one important example.[63] Finally, as suggested by the World Health Organization[10], professional organizations and groups can contribute to national obesity prevention plans, promote and document best practice case studies for policy implementation, and—importantly—increase the consciousness in the non-health sectors of the potential adverse effects of their actions on the ability of people to maintain energy balance.

Practice points

- parents need to be supported in their efforts to promote children's healthy weight via consistent and age-appropriate advice regarding diet, sedentary and active behaviours
- practitioners need to be supported via education and training to fulfil this need
- practitioners are uniquely placed to influence parents and their children and the environments in which much of their time is spent

Research agenda

- there is currently little documented evidence regarding the impact of health professionals and service providers on the prevention of childhood obesity

GOVERNMENT POLICIES

Governments have an intrinsic role in the primary steering, implementation and monitoring of obesity prevention programmes. Every government must also consider actions that will result in the provision of balanced and accurate information that will allow the consumer to make healthy lifestyle choices. This must include investment in obesity prevention surveillance, research and evaluation if polices are to be maintained and updated.

Obesity is, however, beginning to emerge on different government agendas. In the USA, the Institute of Medicine (IOM) was charged with the responsibility of developing an action plan for preventing childhood obesity.[64] In the UK, the need for national strategies to prevent childhood obesity has been highlighted by a number of recent policy documents, including the Health Select Committee Report on Obesity (2004)[65] and the National Service Framework for Children (www.dh.gov.uk), in addition to the public health White Paper 'Choosing Health'[66] that has the reduction of childhood obesity as one of its key themes alongside tackling inequalities. This has stimulated the development of regional obesity strategies and the implementation of the National Healthy Schools Scheme which aims to promote physical activity and healthy diets throughout schools in England and Wales (www.wiredforhealth.gov.uk). In a similar vein, the Australian government has released a national action agenda (www.healthyactive.gov.au/docs/healthy_weight08.pdf) which outlines a comprehensive, multisectoral, collaborative approach to the issue and recommends actions across a range of settings such as child care, schools, primary care, maternal and infant health care, neighbourhoods, workplaces, food supply, family and community services, media and marketing.

Practice point

- paediatric obesity prevention has made the government agenda within many countries, although active policy implementation is lagging

Research agenda

- governments must be encouraged to invest in obesity prevention surveillance, research and evaluation upon which effective policies can be formulated

MONITORING AND EVALUATING PREVENTION STRATEGIES

To halt the prevailing rise in childhood obesity there is an urgent requirement to develop appropriate intervention measures and monitor the impact these have on prevalence patterns. This requires two key elements: (1) a suitable tool to monitor obesity, and (2) effective study designs with the strength to evaluate 'high-dose' changes in obesity prevalence.

Power et al[11] commented that 'an ideal measure of body fat should be accurate in its estimate of body fat; precise, with small measurement error; accessible, in terms of

simplicity, cost and ease of use; acceptable to the subject; and well documented, with published reference values'. It was also suggested that 'no existing measure satisfies all these criteria'. The measurement of adiposity in children is performed in several settings such as population research, clinical research, primary and tertiary health care. Whilst direct measurements of adiposity—such as underwater weighing, magnetic resonance imaging (MRI), computerized axial tomography (CAT) and dual energy X-ray absorptiometry (DXA)—may provide more accurate measures of adiposity, they are costly, time-consuming, and require specialist equipment and expertise. These techniques are therefore not suitable for use across the spectrum of settings. To date, the most widely accepted measures of adiposity are gained from indirect anthropometric measurements of BMI and waist circumference. Both techniques have been validated against DXA measurements[67,68], are inexpensive, reliable, and used across different settings to provide an indirect measure of adiposity and abdominal adiposity, respectively.

Although BMI can have limitations when used in individuals with unusual body fat distribution, which can be due to extreme stature, muscle mass or ethnic group, it remains one of the most effective monitoring tools available. At present, obesity monitoring in most developed countries is reliant upon occasional large surveys, which result in the delayed production of spasmodic data. Currently, the UK Essential Core Dataset for child health (www.chiconsortium.org.uk) recommend recording BMI at primary school entry and secondary school entry and exit. However, at present in the UK, height and weight measurements are recorded only at school entry. There is consequently an urgent need to implement more formal, regular monitoring programmes that will give rise to: (1) an accurate, up-to-date representation of childhood obesity trends; (2) the ability to monitor reach, sustainability and population impact of prevention programmes; (3) a suitable population comparison group for effectiveness studies, and (4) a suitable benchmark for schools and local government. These data would consequently greatly benefit future monitoring of paediatric obesity prevention programmes.

Practice point

- body mass index and waist circumference measurements are currently the most widely accepted method of indirectly monitoring childhood adiposity

Research agenda

- regular, large-scale surveillance of childhood obesity is required to measure obesity trends and monitor the impact of prevention strategies

SUMMARY

Paediatric obesity is a complex and growing global problem. Given the tracking of obesity and associated risk factors from childhood through to adulthood, and the limited success of available treatment programmes, it is likely that prevention will provide the only method of containing this epidemic. However, the evidence base is weak, with recent systematic reviews and meta-analyses concluding almost unanimously that the existence of high-quality evidence for the prevention of childhood

obesity is limited. The evidence suggests that a global approach that includes various components and settings, such as home, school and community, is likely to achieve better results. A number of studies has been performed in the school setting, but many were based in the USA, and the outcomes of these could prove difficult to repeat in other countries because of environmental and cultural differences. There is also a lack of evidence for preventative interventions during the preschool and antenatal periods, despite mounting evidence to support the genetic, environmental, behavioural and parental influences during this critical early period of life. Prevention programmes during these early years would also be supported by the emerging evidence suggesting the protective effect of breast-feeding and correct weaning on the prevention of paediatric obesity.

Indeed, many questions remain within this field and urgently require action that is comprehensive, sustained and evidence-based. Consequently, an evidence-based, decision-making framework has been developed for obesity prevention by the International Obesity Task Force. The framework, described by Swimburn et al[69], is defined by five key policy and programme issues: (1) building a case for action on obesity; (2) identifying contributing factors and points of intervention; (3) defining the opportunities for action; (4) evaluating potential interventions; and (5) selecting a portfolio of specific policies, programmes, and action. This new framework highlights the lack of efficacy and effectiveness studies as problematic in relation to action 4 (the evaluation of potential interventions). However, it also acknowledges that the evidence base for obesity prevention requires many different types of evidence which 'often needs the informed opinions of stakeholders to ensure external validity and contextual relevance'.[69] This must nevertheless be accompanied by improved monitoring and surveillance of paediatric obesity to track prevalence patterns and measure the impact of future preventative strategies.

CONFLICT OF INTEREST

None of the authors has any conflicting interests.

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