GLAINTELLIGENCE UNIT

Childhood Obesity in London

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Executive summary

This paper provides a summary of a number of issues relating specifically to childhood obesity in order to support the work of the London Assembly's Health and Public Services Committee in this area.

Childhood obesity in England as a whole is increasing and is a significant problem facing London. Data for 2009/10 shows that in London, 11.6 per cent of children aged 4-5 years and 21.8 per cent of children aged 10-11 years were at risk of being obese. This is higher than the English average for both age groups. For children aged 4-5 years in London, the percentage thought to be at risk of being obese has remained relatively static over the last three years. Among the 10-11 year age group, the percentage of those at risk of being obese has increased slightly over the last three years. Boys are at greater risk of being obese than girls for both age groups. The prevalence of children at risk of obesity is highest in the most deprived areas and there is significant inequality across London. Children from certain ethnic minority groups such as Bangladeshi, Black Caribbean and Black African were found to be at a higher risk of obesity but analysis by the National Obesity Observatory suggests that ethnicity is not as strongly linked to obesity as deprivation because weight differences between ethnic groups may be linked to differences in body composition and other physical categories such as height[1].

Currently projections for child obesity at a London level are unavailable. National projections based on Health Survey for England data 1993-2004 show that by 2050 a quarter of young people under 20 years of age will be obese. Data from 1993-2007 suggests that over the most recent years, nationally there has been a positive shift in levels of healthy weight amongst children and this is reflected in the predicted weight levels for 2020[2]. However, the increases in obesity that have already occurred should not be ignored, particularly since the nature of obesity-related diseases such as diabetes and heart disease can take several decades to manifest (Kopelman,2008).

Childhood obesity is associated with significant psychological and physiological health problems. It has been linked to low self-image, low self-confidence and depression in some obese children, even at a very young age (Parliamentary Office of Science and Technology, POST 2003). The risk of these psychological problems developing increases with age, and this is particularly the case for girls. Evidence also suggests that obese children have a greater propensity to become obese adults later in life. POST (2003) asserts that overweight adolescents have a 70 per cent chance of becoming overweight or obese adults. This increases the risk of developing a range of chronic diseases such as diabetes and coronary heart disease.

Medical and scientific evidence shows that obesity is caused, at its most basic level, by an intake of calories in excess of calories expended (POST 2003). This suggests that obesity can be overcome by reducing calorie intake and/or increasing physical activity (calories expended). However, there are other factors, such as cultural and social pressures, that can make it difficult for people to adapt their behaviour to make changes to their diet and lifestyle. The prevalence of childhood obesity has been linked with various socio-economic and lifestyle factors. Some of these include household income, parental BMI, child gender and physical activity level (Upton et al. 2010). In addition to this, humans are physiologically predisposed to consume excess calories as a self-preservation method to ward off starvation (Swanson, 2008).

Childhood obesity is also closely linked to parental and family influence. If a child has at least one obese parent, they are around three times more likely to be obese than a child with no obese parents (McCormick et al. 2007). Parents can have a significant bearing on the food and activity that they provide to their children, but for a variety of reasons may not always encourage the healthiest choices.

1 *National Child Measurement Programme, Analysis by National Obesity Observatory*

2 *Tackling Obesities: Future Choices – Project Report, Foresight, 2007 and Obesity Trends for Children Aged 2-11 Analysis from the Health Survey for England 1993 – 2007, National Heart Forum, 2009*

This may be because parents have difficulty providing nutritious food due to a lack of information or conflicting marketing messages about what the best food choices are; or that some 'junk food' options may be cheaper alternatives to fresh, healthy food. Given the current economic situation, people may buy food that is cheaper, more energy dense and nutrient poor.

Social networks are also identified as important; the Framingham Heart Study, a long-term cardiovascular study in the town of Framingham, Massachusetts, found that the chances of a person becoming obese rose by 57 per cent if he or she had a friend who became obese. The key common modifiable risk factors of obesity identified by Kipping et al. (2008) include high levels of television viewing, low levels of physical activity, parental inactivity, and high levels of consumption of dietary fat, carbohydrate and sweetened drinks.

Despite the high prevalence of obesity amongst young Londoners, they have an extremely positive perception of their health. Ninety-six per cent of people aged from 11 to 16 believe their health is good or very good[3]. This suggests that either young people do not understand the health implications of obesity or that they do not recognise that they are obese. Parents also have a limited awareness of their child's weight status; research shows that the majority do not recognise that their child is overweight or obese[4].

Children do have a good awareness of what foods are healthy and can identify the consequences of not eating healthily however they do not see it as their role to be interested in health and do not see messages about their future health as personally relevant.

The percentage of young people who say they eat five or more portions of fruit and vegetables a day varies considerably across London, from 14 per cent in Tower Hamlets to 33 per cent in Camden, Kensington and Chelsea and Wandsworth[5]. There has also been an increase in the take-up of school meals in London although children in secondary schools and those living in Outer London are much less likely to have school meals. The average cost of a school dinner is more expensive in secondary schools and also in Outer London compared with Inner London so this could affect take-up[6]. London also has a higher number of fast-food outlets per secondary school than any other region[7]. American research (Currie et al. 2009) found that having a fast food outlet within 0.1 miles of a school increases the probability of child obesity by 5.2 per cent.

While 80 per cent of young Londoners claim to play sport very or quite often, only one in three boys and one in four girls achieve the recommended level of at least 60 minutes of physical activity per day. Levels of self reported participation in sports activities and the use of green space have increased but there is also a significant number of 11 to 16 year olds who are not particularly active; three per cent say they never do any exercise of 30 minutes or more and six per cent say they exercise for 30 minutes or more less than once a week. Young people felt they didn't play sport because they had other things to do (30 per cent) or because they didn't have time (22 per cent) and over one fifth (22 per cent) said they just didn't want to[8].

McCormick et al. (2007) show evidence that lifestyle patterns of food consumption and exercise are set early in life. Research conducted by proponents of the MEND programme (MEND 2010) suggest

3 Young Londoners' Survey, Greater London Authority, 2009

4 Childhood obesity food advertising in context, National Opinion Poll for Ofcom, July 2004

5 Tell Us 3, Ofsted reports by Local Authority, September 2008

6 Take-up of School Meals in England, School Food Trust, 2009/10

7 Temptation Town, School Food Trust, 2008

8 Young Londoners' Survey, Greater London Authority, 2009

that childhood obesity is a leading predictor of obesity in adulthood and tackling the obesity problem requires intervention at an early age. Once children become overweight or obese, they are also less likely to exercise due to a lack of confidence, health difficulties or poor performance[9]. This will make it more difficult to lose weight and will further exacerbate the problem.

Measures to address obesity can be thought of as falling into three broad categories:

- "Weight management programmes" targeted at individuals *who are already overweight or obese*, with the intention of helping them reduce or manage their weight;
- Preventative interventions; and,
- Wider prevention activity, particularly focussing on environmental factors such as the built environment, availability of services, and food systems.

For the most part this analysis considers the first two intervention types. Obesity prevention programmes need to address a range of complex factors if they are going to be effective in modifying behaviour. The main aspects of obesity prevention or reduction programmes include education, nutrition advice, behaviour change programmes, physical activity, and parental development.

There are a number of programmes that have been implemented in the UK and internationally to address the rising trend of obesity, but few have been rigorously evaluated – particularly in terms of cost-benefit analysis or cost-effectiveness. While it is clearly a complex area, it was found that community or school based programmes that are non-stigmatising can maintain child participation and achieve favourable outcomes. In addition, parents and carers have a very important influencing role in terms of diet and lifestyle and many of the best performing interventions involved both the child and parent. Early intervention is important for establishing healthy lifestyles and behaviours at an early age; and programmes that promote a healthy lifestyle were shown to be more effective than those focussed only on weight. Indeed, it was often argued that early prevention and intervention is more effective and less costly than treatment and other consequences of obesity later in life. Limiting television viewing and "screen time" was also effective in addressing sedentary lifestyles. When developing childhood obesity interventions it is important to consider this evidence of effectiveness (particularly cost-benefit analysis and cost-effectiveness) as well as any unintended consequences that might occur as a result of the programme. Importantly, interventions should include evaluation to allow analysis of what works well, and what is less effective (again particularly in terms of cost-benefit analysis and cost-effectiveness).

In terms of the current costs of obesity, they are generally divided into two distinct areas:

i) the direct costs of treating obesity and the consequences of obesity (such as diabetes); and,
ii) the indirect costs of obesity – principally through the loss of earnings due to sickness and premature mortality.

As children do not work, this note focuses primarily on the direct costs of childhood obesity to London. A full, detailed, primary assessment of the costs of obesity would be beyond the remit of this report and so the estimates presented here are derived from previous estimates of the costs of obesity at the national level.

Looking specifically at the direct costs, GLA Economics' best estimate of the current cost of publically funded treatment of childhood obesity and its associated consequences in London is £7.1 million a year. It should be noted that this is a rather simple estimate and reliant on a number of simplifying assumptions.

9 Earlybird Diabetes Study, Peninsular Medical School, 2008

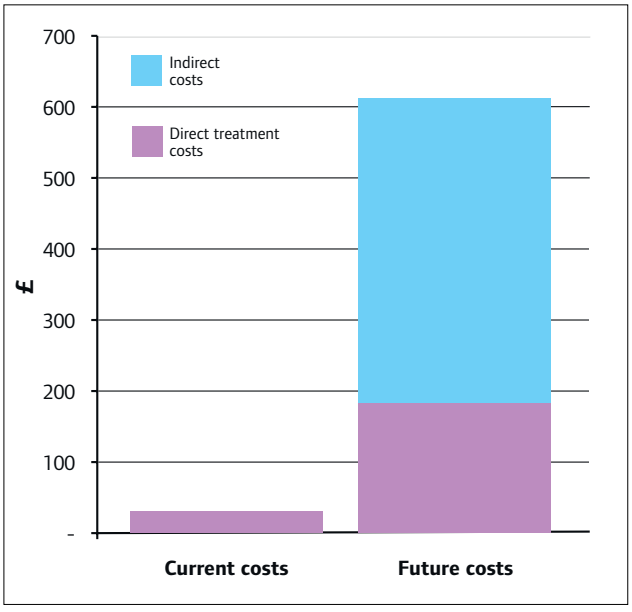
The total costs of childhood obesity to London in the long run will be much higher than this because many of the treatment costs and consequences of obesity (such as cardio-vascular disease, diabetes and some cancers) are not likely to be incurred until later in life (ie not in childhood). This is also true for the wider indirect costs such as lost productivity through sickness and premature death; they will be incurred in later life not in childhood.

In London, the direct treatment costs of adult obesity – which could be considered as a proxy for the likely future costs of childhood obesity – are estimated to cost around £265.2 million a year in 2007. This represents roughly 2 per cent of total DoH identifiable expenditure on services in London in 2007/8. This is also equivalent to an estimated average treatment cost of around £184 per obese adult per year in 2007. As an upper limit, therefore, if we assume 79 per cent[10] of currently obese children in London become an obese adult, childhood obesity could represent a direct cost of around £33.3 million a year to London (assuming the direct treatment costs of obesity remain unchanged)[11].

Including the indirect costs of adult obesity (such as lost income from sickness and premature mortality), the total cost of adult obesity is estimated at around £883.6 million a year in 2007. This represents roughly 0.4 per cent of London's GVA in 2007[12] and an average cost of £611 per obese adult per year in 2007. Therefore, again as an upper limit, if we assume 79 per cent of currently obese children in London become an obese adult, childhood obesity could represent a total cost (direct and indirect) of £110.8 million a year to London's economy (assuming both indirect and direct costs remain unchanged).

In summary, an obese child in London is likely to cost around £31 a year in direct costs which could rise to a total (direct and indirect) cost of £611 a year if they continue to be obese in adulthood *(Figure ES1)*.

Figure ES1: Breakdown of current and future annual costs per obese child in London



Note: The likely future costs have been proxied by the current costs of adult obesity in London. Not every obese child will grow up to be an obese adult so the future costs presented here can not be assumed to apply to every obese child in London.

It should be noted that several methods by which to calculate the costs of childhood obesity have been considered and these are detailed in Annex 2-6 in the main report. Given the current state of knowledge the estimates above represent GLA Economics' best estimate of the costs of childhood obesity, but the number of simplifying assumptions and nature of the underlying estimates used mean that these estimates should be used with caution.

10 From HM Government report 'Healthy weight, healthy lives: a cross-government strategy for England' report which states that 55 per cent of obese 6-9 year olds and 79 per cent of obese 10-14 year olds remained obese into adulthood. As a result, as stated in the note, the use of the 79 per cent figure is likely to provide an upper limit to this estimate

11 Based on an estimated 1,445,090 obese adults and 229,383 obese children in London in 2007

12 Residence based smoothed GVA at current basic prices, ONS

Introduction

The GLA Intelligence Unit were asked to support the work of the London Assembly's Health and Public Services Committee on childhood obesity. This paper provides a summary of the economic, demographic and opinion data and analysis specifically around childhood obesity produced by the GLA Intelligence Unit. **Section 1** outlines the current situation in London in terms of the prevalence of childhood obesity and provides national projections for child obesity. **Section 2** considers certain causes of obesity including the influence of family and social networks, access to healthy food and recreational facilities and attitudes towards health, healthy eating and physical activity. **Section 3** looks at the effectiveness of interventions for childhood obesity and highlights the characteristics of effective and ineffective programmes. The final section, **Section 4** provides an estimate of the costs of childhood obesity in London.

1. Obesity prevalence and projections

Obesity prevalence

The data presented on obesity prevalence include figures relating specifically to London, data presented on obesity projections are national with wide confidence intervals.

The Health Survey for England shows that the percentage of children aged between 2 and 15 years of age, classified as overweight or obese is increasing, with most of this increase due to an increase in obesity **(Figures 1 to 3)**. Between 1997 and 2007, the percentage of overweight or obese boys aged 2-10 years increased from 24.6 per cent to 29.8 per cent and for girls, from 22.9 per cent to 28.6 per cent. Among the 2-10 year old cohort, more boys are obese than girls and in recent years more girls have been classified as overweight than boys. Among the 11-15 year old cohort, generally more girls are classified as overweight or obese than boys.

Data relating specifically to London is available from the National Child Measurement Programme (NCMP). The programme identifies the percentage of children aged 4-5 and 10-11 years , at risk of being overweight or obese, by gender and Primary Care Trust. The term 'at risk' is used with NCMP data here to indicate that the analysis does not provide the number or percentage of children who have been clinically defined as obese or overweight. Numbers and percentages are based on cut-off points used for population monitoring. For example, of all children measured, children that fall into the 5% of the standard growth reference chart (1990) with the highest BMI will be classified as obese and the 5% with the lowest BMI will be classified as underweight[13,14].

In 2009/10, 11.6 per cent of children aged 4-5 years and 21.8 per cent of those aged 10-11 years are at risk of being obese. This is higher than the English average for both age groups. **(see Table 1)**

Table 1: Percentage of children at risk of being overweight/obese 2009/10

Percentage of children at risk of being overweight 2009/10				
	Reception year (4-5yrs)		Year 6 (10-11yrs)	
	London	England	London	England
Males	12.7	13.9	15.1	14.6
Females	12.2	12.7	15.0	14.6
All	12.7	13.3	15.1	14.6
Percentage of children at risk of being obese 2009/10				
	Reception year(4-5yrs)		Year 6 (10-11yrs)	
	London	England	London	England
Males	12.3	10.5	24.0	20.4
Females	10.9	9.2	19.5	17.0
All	11.6	9.8	21.8	18.7

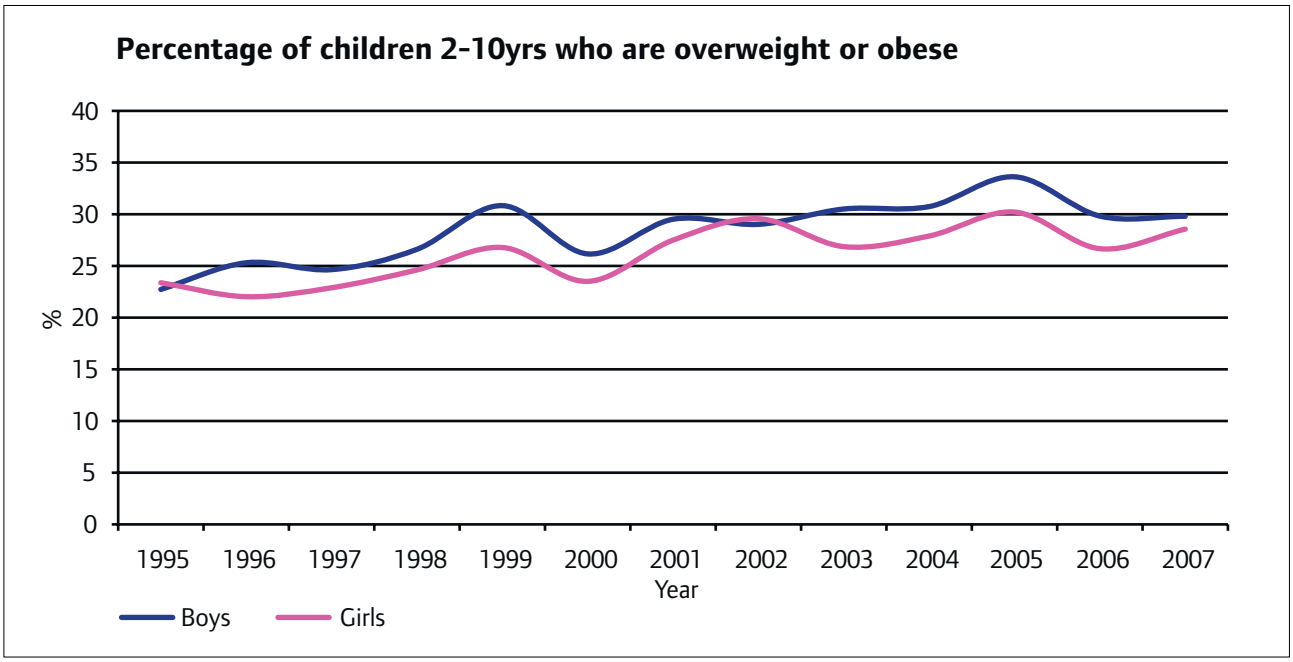
Source: NCMP, Analysis by National Obesity Observatory. BMI Classification UK90 Population Monitoring Cut-offs.

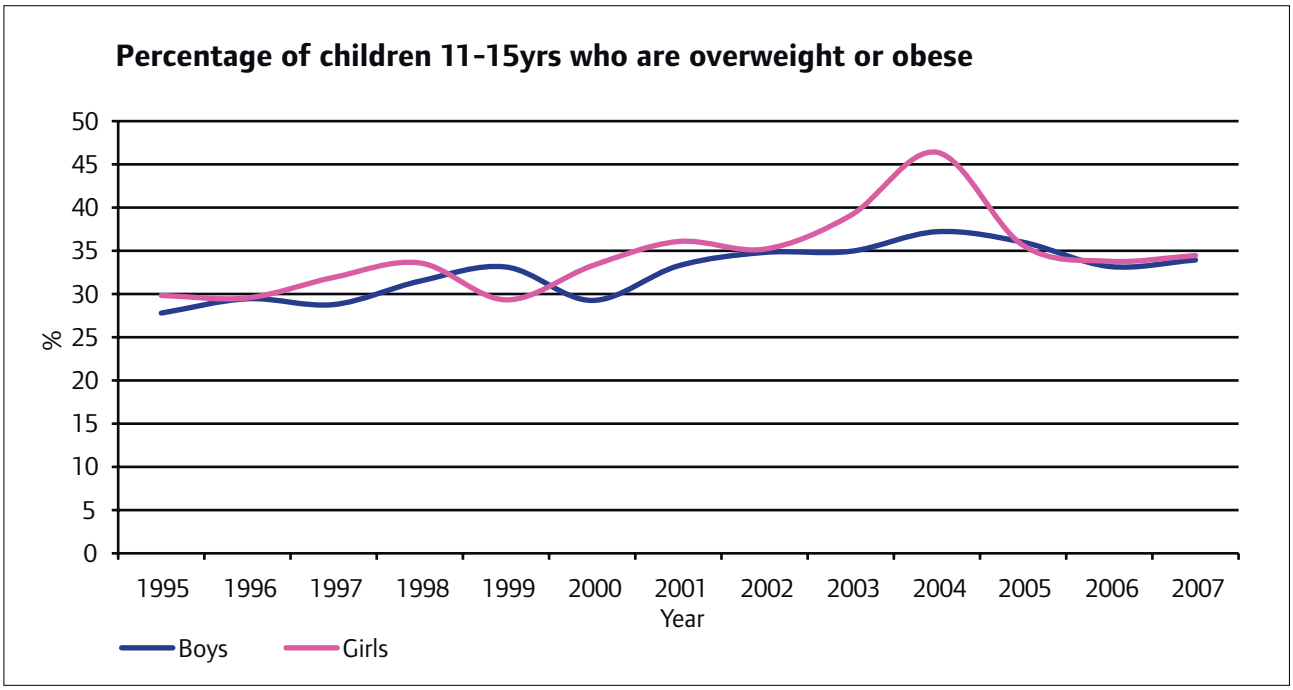
For girls aged 4-5 years in London, the percentage thought to be at risk of being overweight remained relatively static between 2006/07 and 2008/09 but has increased over the last year to 12.2 per cent. For boys there has been a slight increase from 12.3 per cent in 2006/07 to 12.7 per cent in 2009/10. The percentage of 4-5 year olds who are at risk of being obese has also remained static over the last three years.

13 Focus on London: Health, Children and Young People, Greater London Authority, 2010

14 Weighty Matters The London findings of the National Child Measurement Programme 2006 to 2008, May 2009

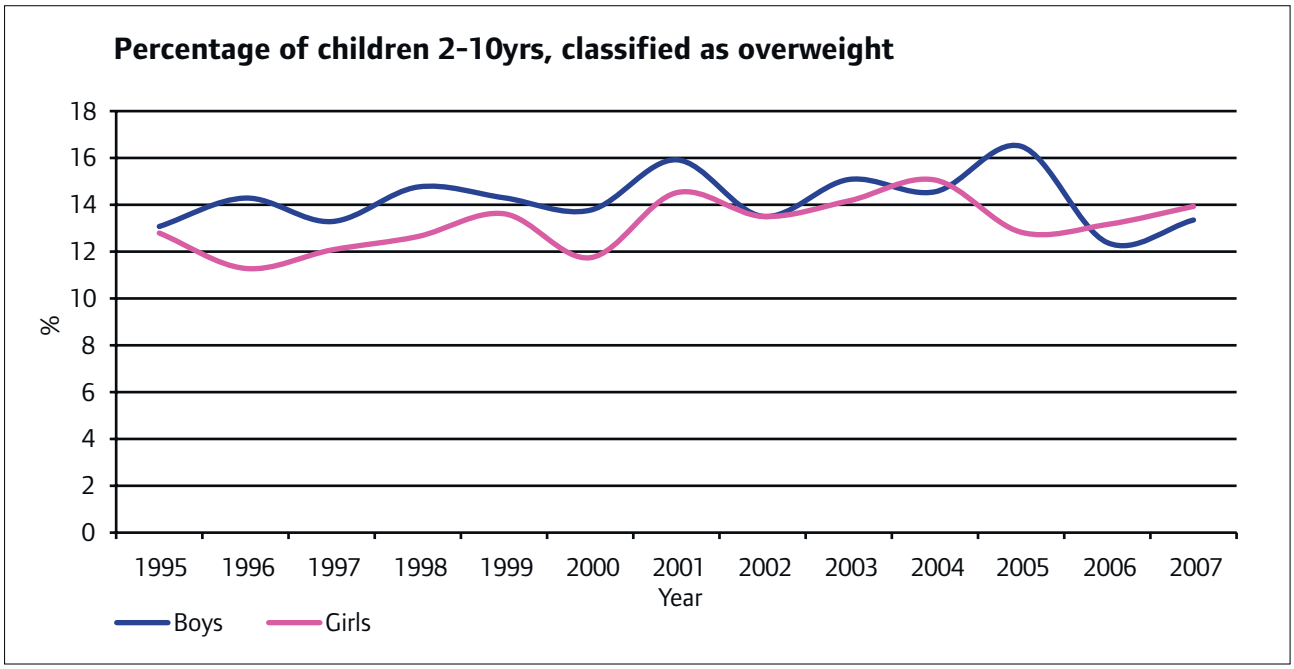
Figure 1: Percentage of children (2-10 yrs and 11-15 yrs) who are overweight or obese

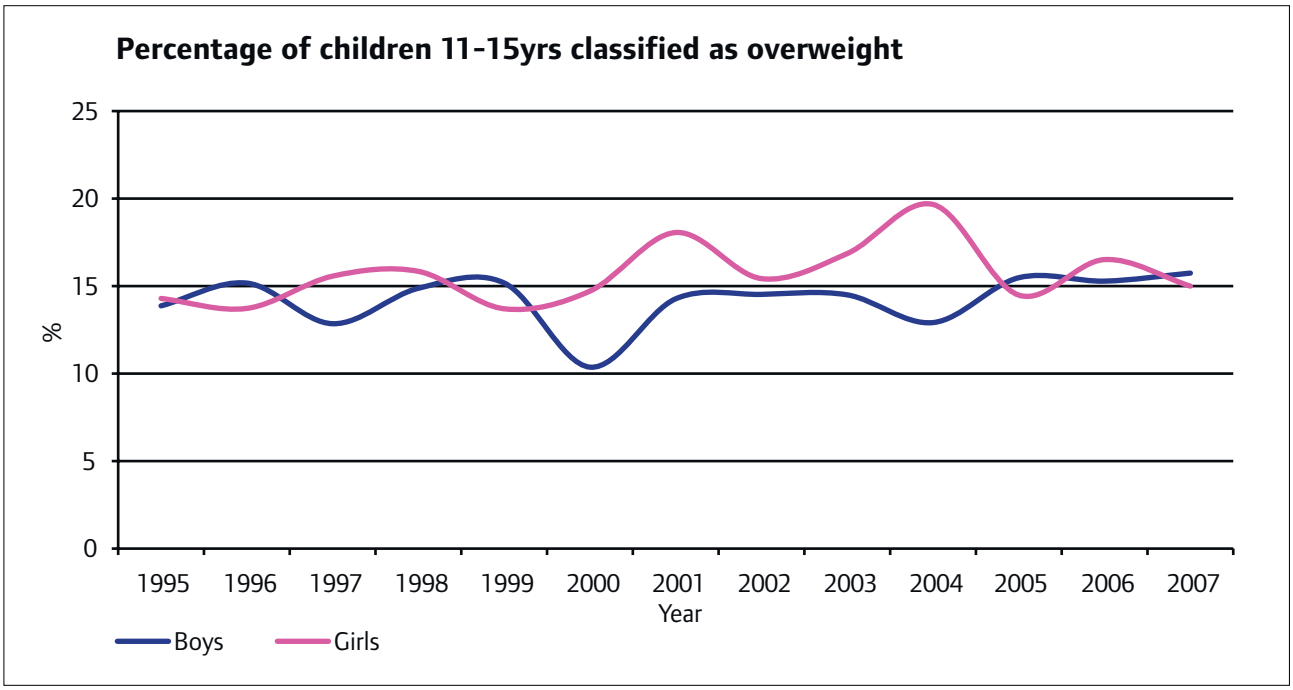




Source: The Health and Social Care Information Centre, Lifestyles Statistics

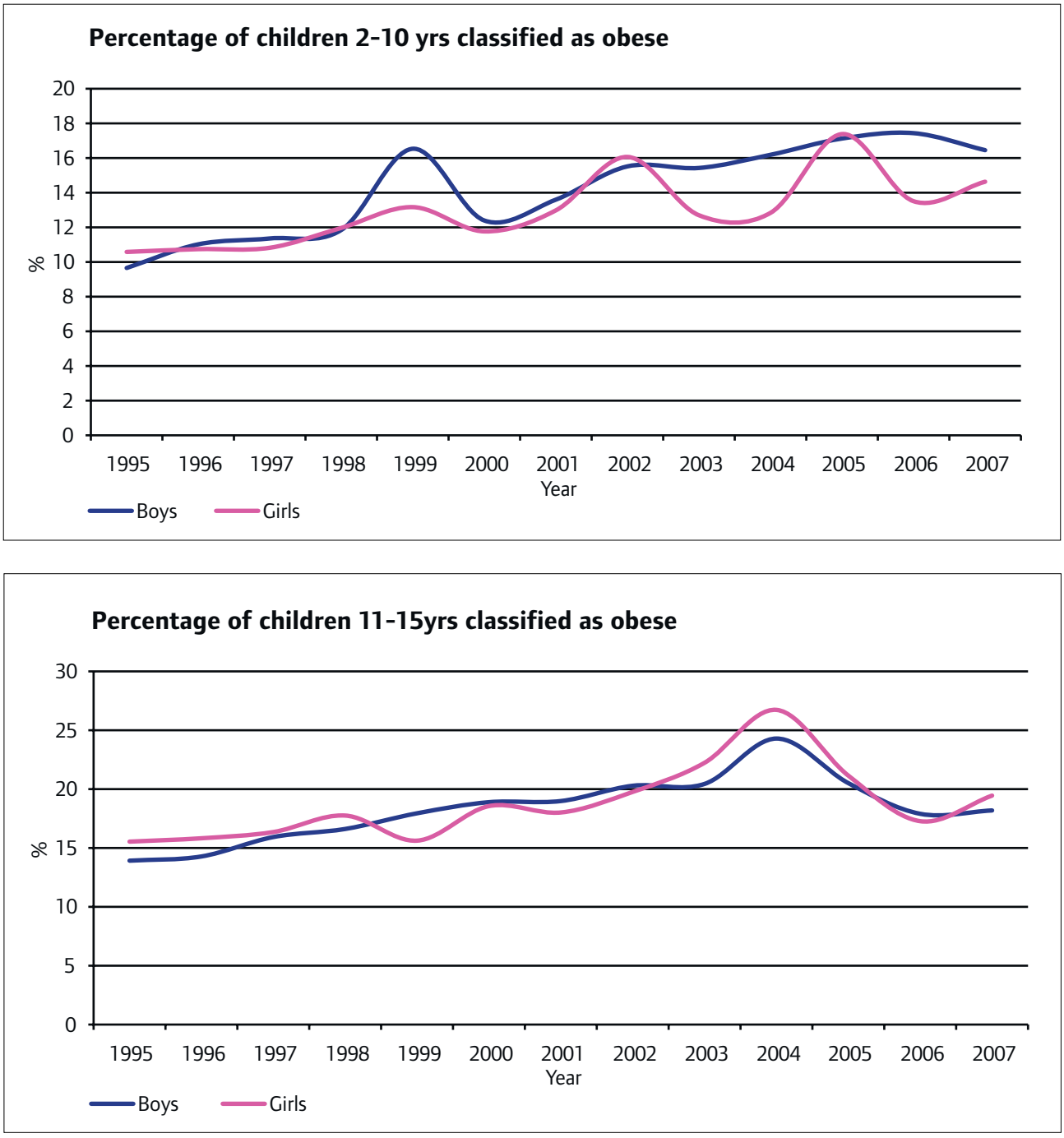
Figure 2: Percentage of children (2-10 yrs and 11-15 yrs) classified as overweight





Source: The Health and Social Care Information Centre, Lifestyles Statistics

Figure 3: Percentage of children (2-10 yrs and 11-15 yrs) classified as obese



Source: The Health and Social Care Information Centre, Lifestyles Statistics

Among the 10-11 year olds in both genders the percentage at risk of being overweight has increased slightly to around 15 per cent. The percentage of 10-11 year olds at risk of being obese has also increased for both girls and boys. Boys are at greater risk than girls of being obese for both age groups.

Figures 4-7 show the significant inequality in the risk of obesity across London. The prevalence of children at risk of obesity is highest in the most deprived areas for example among 4-5 year olds, the risk of child obesity in Southwark is twice as high than in more affluent areas such as Richmond (14 per cent v 6-7 per cent) and some variation can be explained by differences in ethnic profile within these areas[15].

15 Further explanation can be found in 'Causes of childhood obesity in London: diversity or poverty?', London Health Observatory, November 2010

Figure 4: Percentage of 4-5 yr old boys at risk of being obese 2009/10

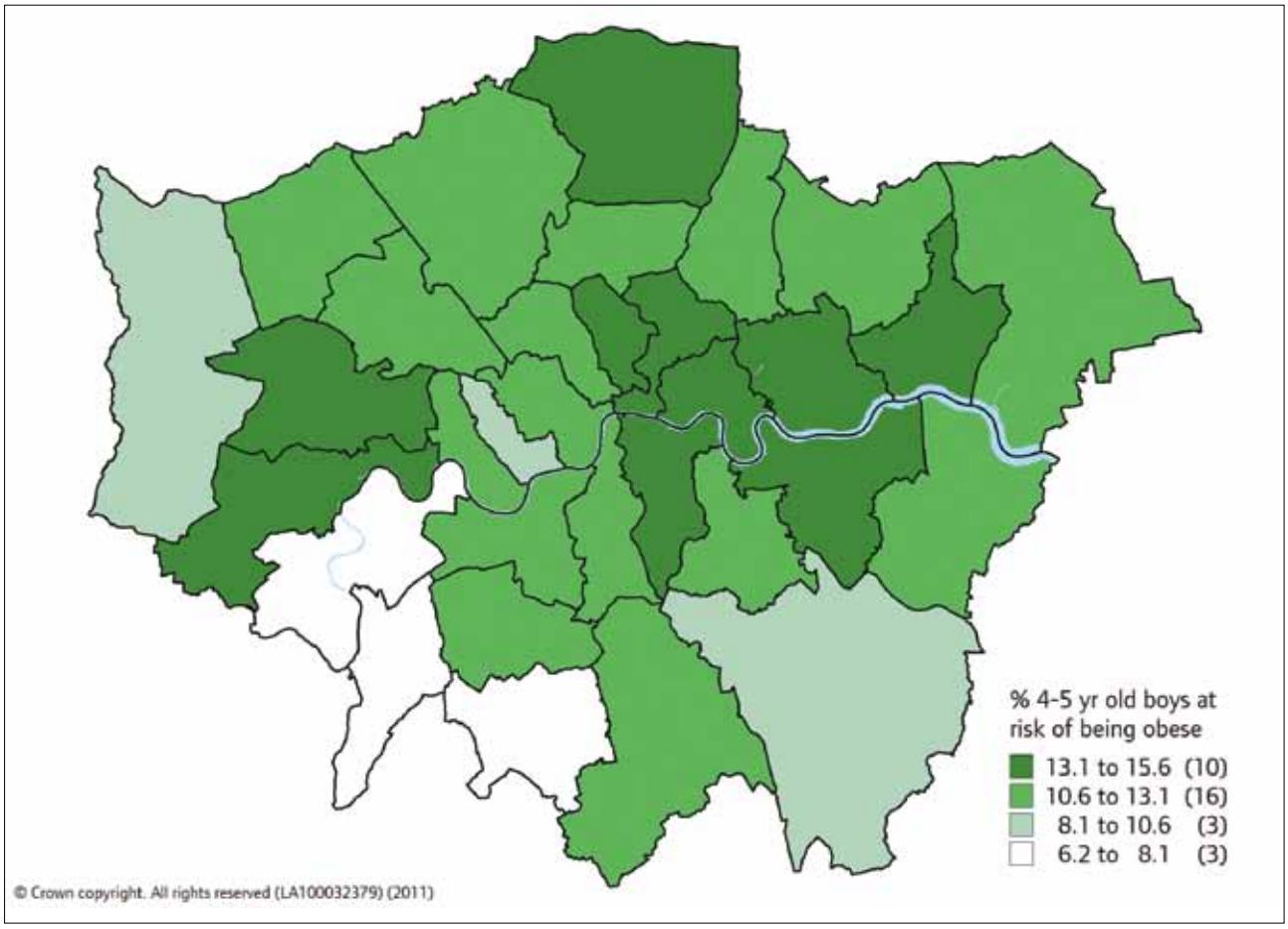


Figure 5: Percentage of 4-5 yr old girls at risk of being obese 2009/10

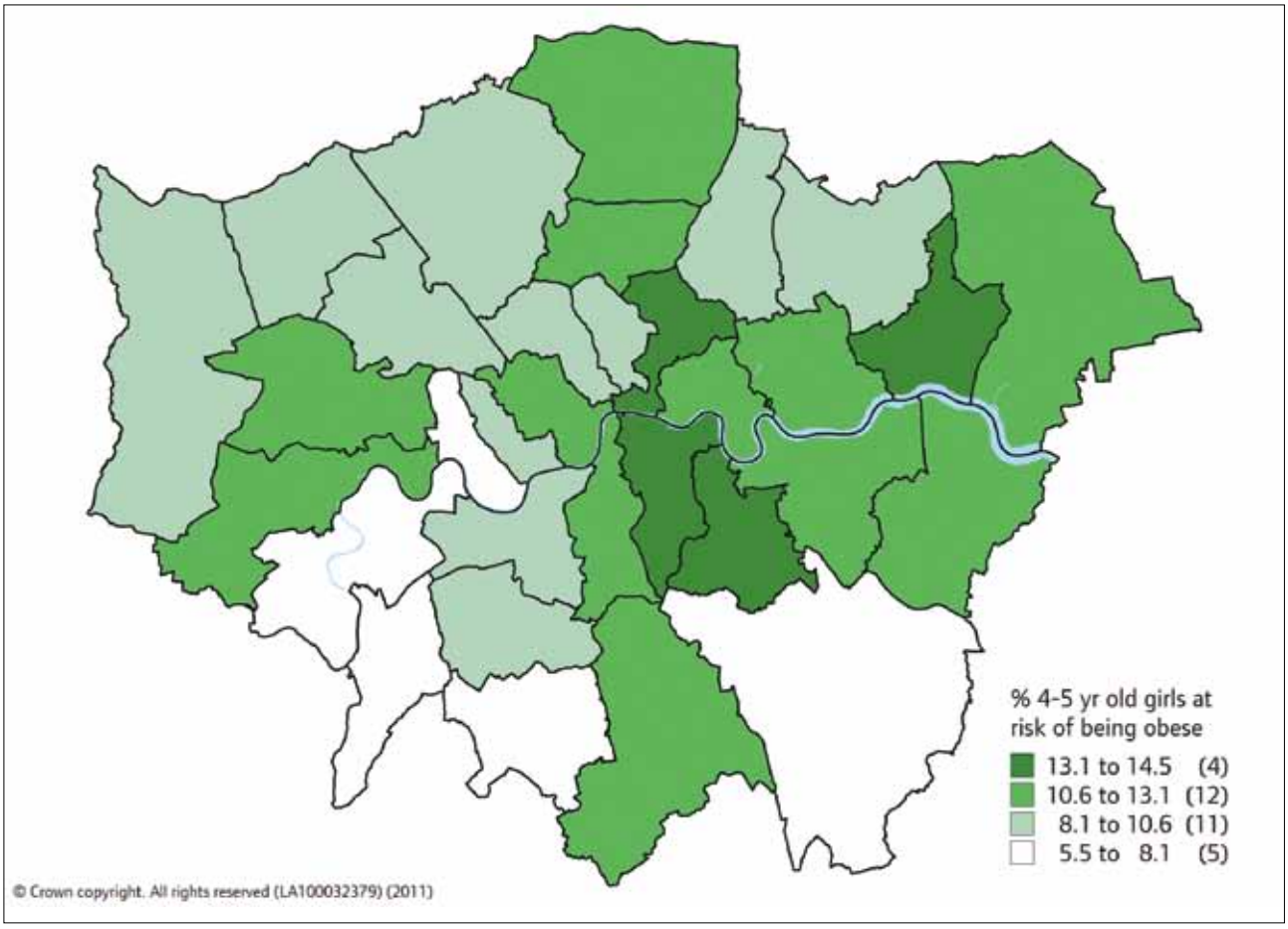


Figure 6: Percentage of 10-11 yr old boys at risk of being obese 2009/10

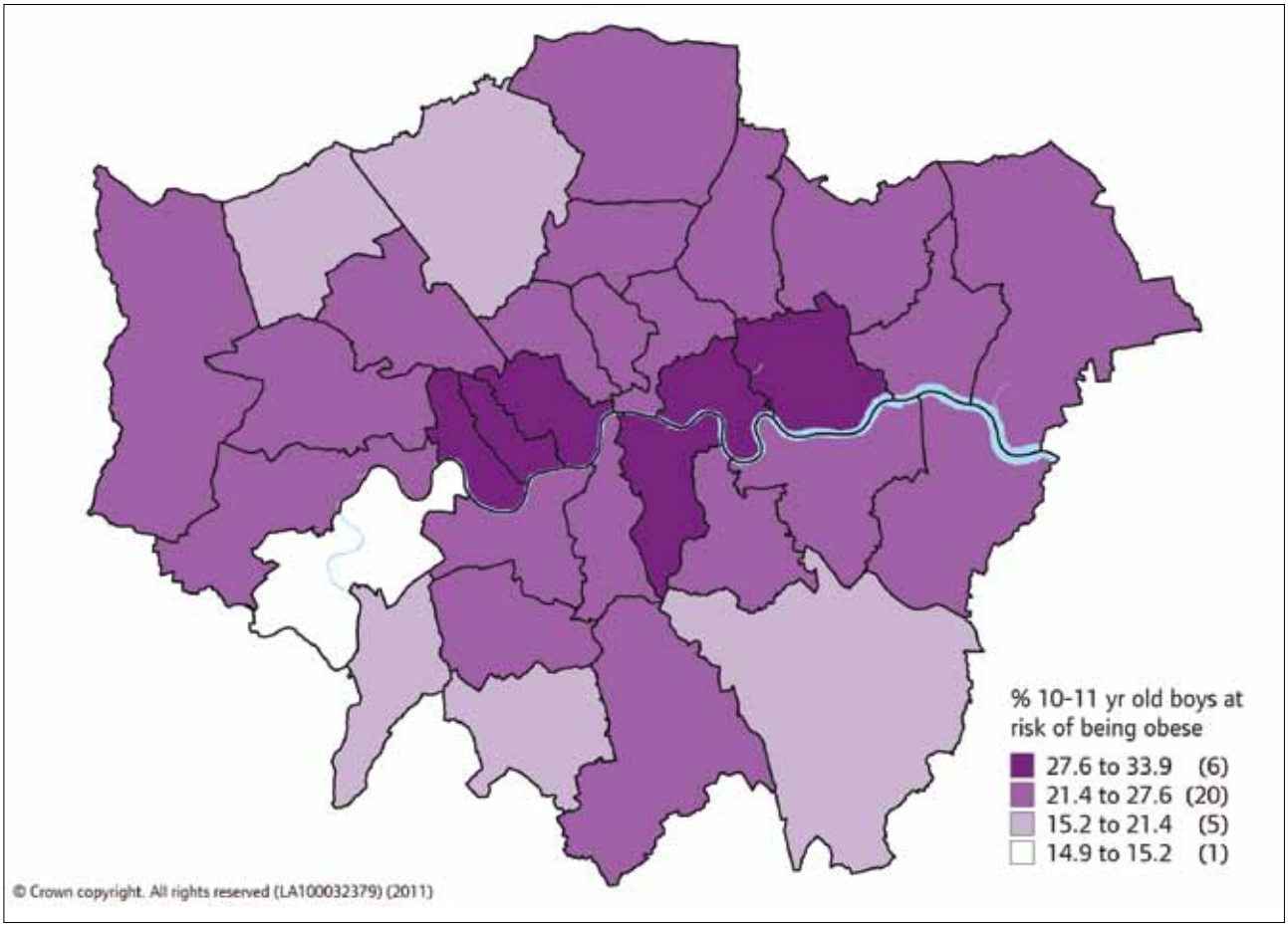
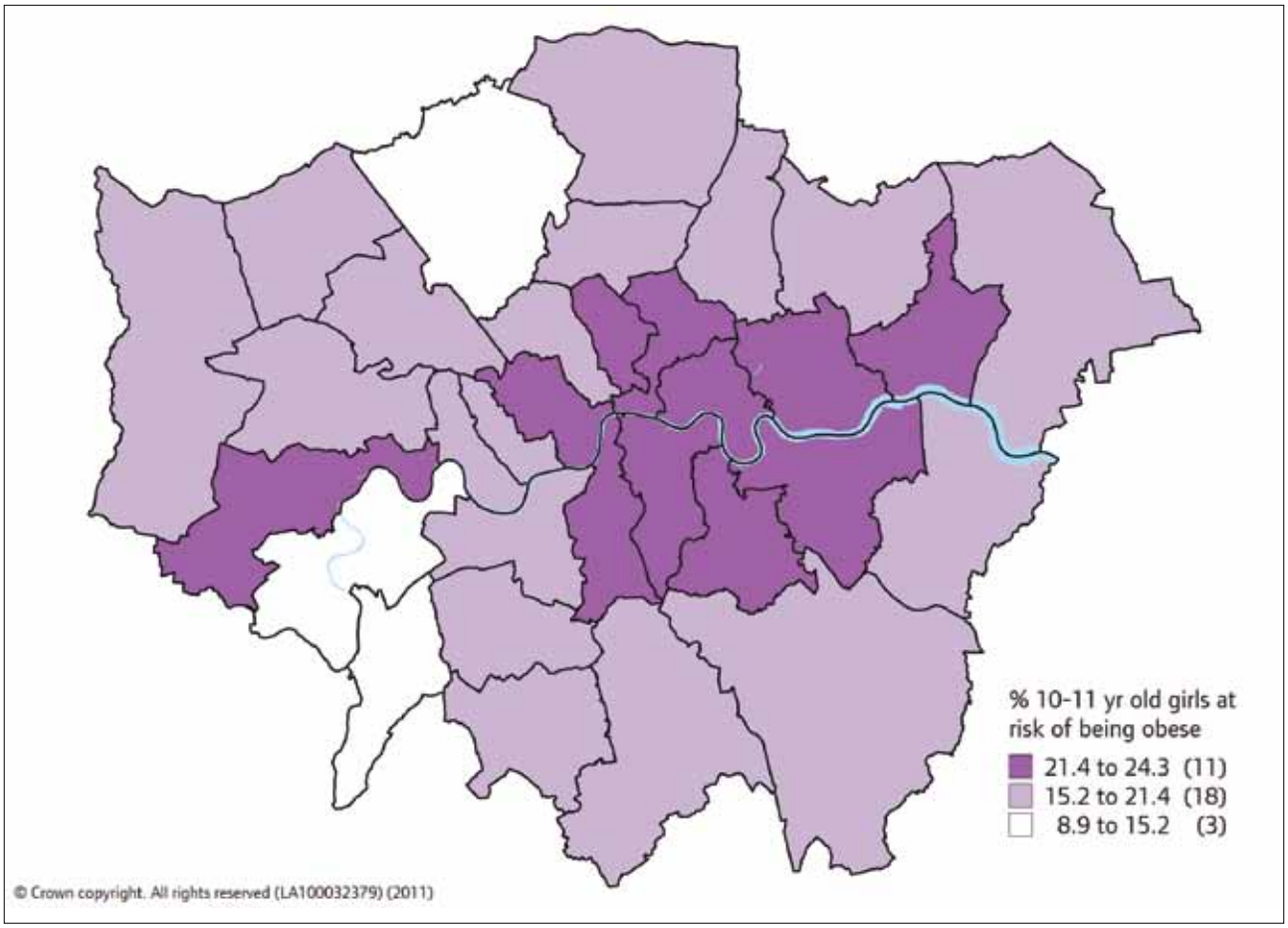


Figure 7: Percentage of 10-11 yr old girls at risk of being obese 2009/10



National obesity projections

Projections for child obesity at a London level are currently unavailable. London level analysis may be undertaken in the future, based on the National Child Measurement Programme. In the meantime, there are two main data sources, containing predictions for levels of child obesity in England for 2020, 2025 and 2050. Foresight based their projections on Health Survey for England data 1993-2004 and the National Heart Forum included more recent data in their projections, using Health Survey for England data 1993-2007. Foresight predicted that by 2050, a quarter of young people under twenty years of age would be obese[16] **(Table 2)**.

Table 2: Obesity projections for young people under 20 years of age
Percentage of population expected to be obese

Children <20 yrs			
England		**2025**	**2050**
Males	6-10 yrs	21	>35
	11-15 yrs	11	23
	Under 20 yrs	15	25
Females	6-10 yrs	14	20*
	11-15 yrs	22	35
	Under 20 yrs	15	25

**very wide confidence interval*

The following table **(Table 3)** shows the Foresight predictions alongside those calculated by the National Heart Forum. The National Heart Forum data has predictions based on all years of the Health Survey for England data, 1993-2007 and then a split between the first eight years worth of data and the most recent eight years of data. Splitting the data in this way suggests that the most recent Health Survey for England data has seen a positive shift in levels of healthy weight amongst children and this is reflected in the predicted weight levels for 2020[17]. The National Heart Forum report shows much lower levels of overweight and obese children by 2020 than the Foresight work.

16 *Tackling Obesities: Future Choices – Project Report, Foresight, 2007*

17 *Obesity Trends for Children Aged 2-11 Analysis from the Health Survey for England 1993 – 2007, National Heart Forum, 2009*

Table 3: Percent of population by predicted weight level

Predicted weight levels at 2020, IOTF distributions

Children aged 2-11 years					
		Foresight 1993-2004	All years 1993-2007	First 8 years 1993-2000	Last 8 years 2000-2007
Healthy weight	Males	56	66	56	70
	Females	57	67	65	73
Overweight	Males	23	20	31	16
	Females	33	23	24	17
Obese	Males	21	15	13	14
	Females	11	10	11	10
Children aged 12-19 years					
		Foresight 1993-2004	All years 1993-2007	First 8 years 1993-2000	Last 8 years 2000-2007
Healthy weight	Males	58	71	76	78
	Females	37	53	43	66
Overweight	Males	24	20	14	18
	Females	35	32	34	27
Obese	Males	18	9	9	4
	Females	28	15	24	7

IOTF distribution refers to the classification of obesity as defined by the International Obesity Task Force.

Limitations and considerations

Long-term forecasts are vital for public health and the projections presented here provide a useful indication of the future scale of the problem but inevitably there are limitations with the data and modelling which should be kept in mind. In a report prepared for the Department of Children, Schools and Families, Professor David Buckingham suggests that over time and without Government intervention, a significant number of people will modify their diet and lifestyle making the projections meaningless. However, the increases in obesity that have already occurred should not be ignored, particularly since the nature of obesity-related diseases such as diabetes and heart disease can take several decades to manifest (Kopelman, 2008).

2. Causes of childhood obesity

Overview

Medical and scientific evidence shows that obesity is caused, at its most basic level, by an intake of calories in excess of calories expended (POST 2003). In simplistic terms, this means that obesity can be overcome by reducing calorie intake and/or increasing physical activity (calories expended). However, there are many factors, such as cultural and social pressures, that can make it difficult for people to adapt their behaviour to make these changes to their diet and lifestyle. The prevalence of childhood obesity has been linked with various socio-economic and lifestyle factors. Some of these include household income, parental BMI, child gender and physical activity level (Upton et al. 2010). In addition to this, humans are physiologically predisposed to consume excess calories as a self-preservation method to ward off starvation (Swanson, 2008).

Childhood obesity is closely linked to parental and family influence. If a child has at least one obese parent, they are around three times more likely to be obese than a child with no obese parents (McCormick et al. 2007). Weight Concern also report that children with two overweight parents have a 70 per cent chance of being overweight themselves, while those with one overweight parent have a 30 per cent likelihood. In comparison, if neither parent is overweight the child has a 10 per cent chance of being overweight as an adult[18].

Parents can have a significant bearing on the food and activity that they provide to their children, but for a variety of reasons may not always encourage the healthiest choices. This may be because parents have difficulty providing nutritious food due to a lack of information or conflicting marketing messages about what the best food choices are; or that some 'junk food' options may be cheaper alternatives to fresh, healthy food and more available locally. The economic situation and increase in food prices may mean people spend less on food or buy more foods that are cheap, energy dense and nutrient poor[19]. Portion sizes have increased as has the percentage of meals eaten outside the home which have been connected to growing rates of obesity[20]. Meal preparation time is also a factor and can lead to parents purchasing, eating, and feeding their children more prepared food and fast food, which are often higher in calories and lower in nutrients than fresh food[21].

Social networks are identified as important; the Framingham Heart Study, a long-term cardiovascular study in the town of Framingham, Massachusetts, found that the chances of a person becoming obese rose by 57 per cent if he or she had a friend who became obese. The key common modifiable risk factors identified by Kipping et al. (2008) include high levels of television viewing, low levels of physical activity, parental inactivity, and high levels of consumption of dietary fat, carbohydrate and sweetened drinks.

While it is likely that children are inheriting the unhealthy lifestyle habits of their parents, some children are also genetically more susceptible than others (POST 2003). The London Health Observatory found that among London children aged 4-5 years old there was a significantly higher number at risk of obesity in the Bangladeshi, Black Caribbean, Black African, Other Black and Other ethnic groups compared to London as a whole. For those children aged 10-11 years, higher rates of obesity risk were found in Other White, Black Caribbean, Black African, Other Black and Other ethnic

18 *Childhood Obesity: Your Questions Answered, Weight Concern. www.weightconcern.co.uk*

19 *Potential causes and health effects of rising global food prices. Lock K, Stuckler D, Charlesworth K, McKee M. BMJ 2009; 339:269-72*

20 *The role of built environments in physical activity, eating, and obesity in childhood. The Future of Children. Sallis JF, Glanz K. 2006;12(1):89-106*

21 *A Tale of Two ObesCities: Comparing responses to childhood obesity in London and New York City, Municipal Responses to Childhood Obesity Collaborative City University of New York and London Metropolitan University*

groups. Analysis by the National Obesity Observatory suggests that ethnicity may not be as strongly linked to obesity as deprivation because weight differences between ethnic groups may be linked to differences in body composition and other physical categories such as height. The World Health Organisation also considers "that the genes involved in weight gain increase the risk or susceptibility of an individual to the development of obesity when exposed to an adverse environment".

The increased risk of obesity associated with deprivation is greatest for white children and it seems to have much less effect for black children. This suggests that different approaches may be needed to tackle obesity amongst children of different ethnicities. Deprivation also has a greater effect on the risk of obesity for Asian boys than girls. There was no difference between gender in other ethnic categories which suggests that Asian children, at least, would benefit from strategies that consider gender[22].

The following subsections consider specific areas in relation to child obesity. It is not an attempt to capture the "complex web of societal and biological factors that have, in recent decades, exposed our inherent human vulnerability to weight gain", as described by Foresight. The Foresight report (2007) presented an obesity system map with energy balance at its centre and around this, were over 100 variables which directly or indirectly influence energy balance. Seven cross-cutting predominant themes were identified and to understand the wider context of the drivers behind obesity it would be essential to consider the following:

- Biology: an individuals starting point - the influence of genetics and ill health;
- Activity environment: the influence of the environment on an individual's activity behaviour, for example a decision to cycle to work may be influenced by road safety, air pollution or provision of a cycle shelter and showers;
- Physical Activity: the type, frequency and intensity of activities an individual carries out, such as cycling vigorously to work every day;
- Societal influences: the impact of society, for example the influence of the media, education, peer pressure or culture;
- Individual psychology: for example a person's individual psychological drive for particular foods and consumption patterns, or physical activity patterns or preferences;
- Food environment: the influence of the food environment on an individual's food choices, for example a decision to eat more fruit and vegetables may be influenced by the availability and quality of fruit and vegetables near home;
- Food consumption: the quality, quantity (portion sizes) and frequency (snacking patterns) of an individual's diet[23].

Perception of health

Young people have an extremely positive perception of their health which does not match the reality. Ninety-six per cent of people aged from 11 to 16 say that their health is either good or very good. The remaining four per cent think that their health is fair. There are no significant differences by gender although youths in more affluent areas report slightly better health[24]. Data from the Health Survey for England shows that around 20 per cent of 2 – 15 year olds in London are obese, which suggests either young people don't understand the health implications of obesity or that they do not recognise that they are obese[25].

22 Causes of childhood obesity in London: diversity or poverty?, London Health Observatory, November 2010

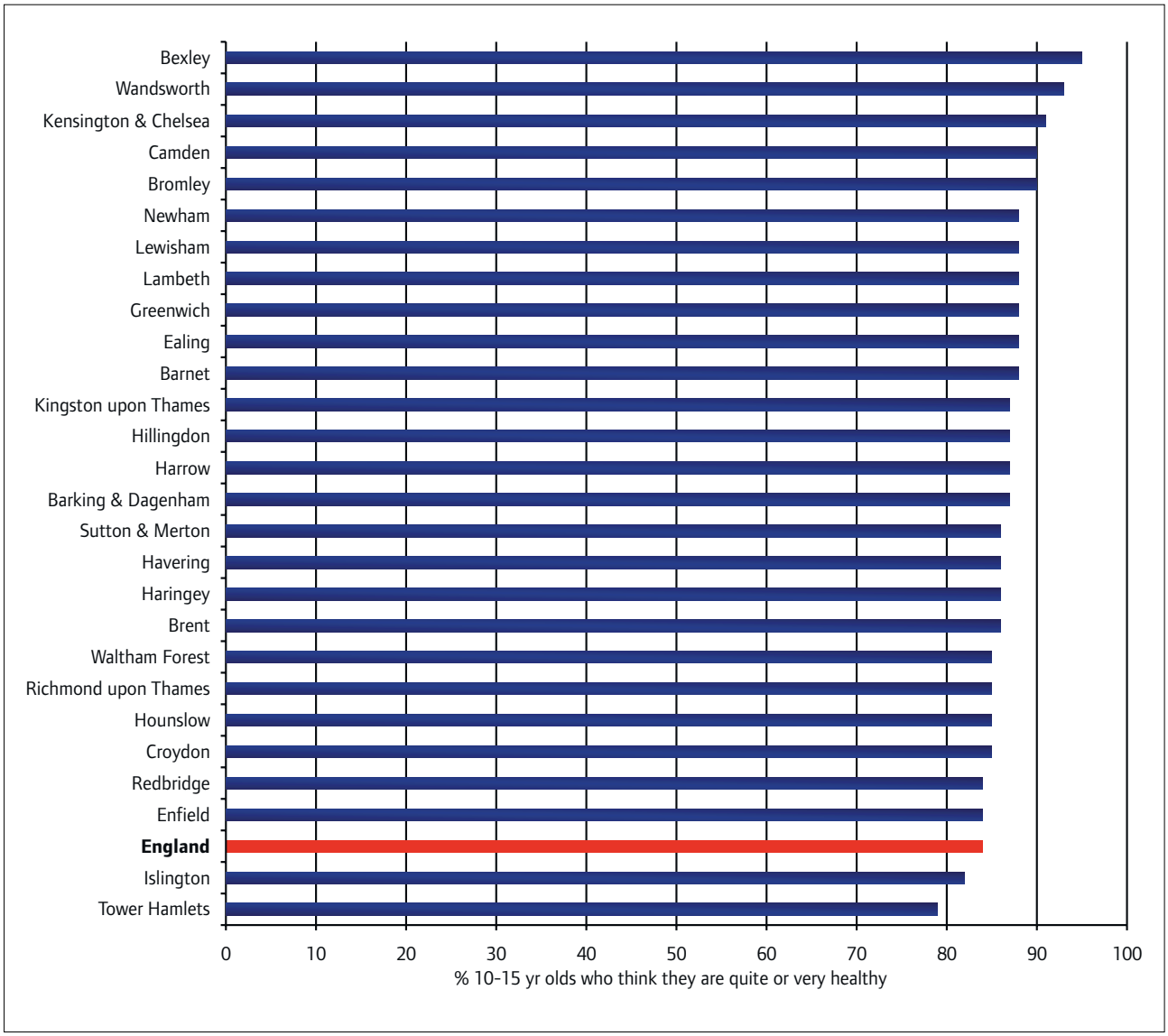
23 Foresight 2007 and National Obesity Observatory, Causes of Obesity: http://www.noo.org.uk/NOO_about_obesity/causes

24 Young Londoners' Survey, Greater London Authority, 2009

25 Health Survey for England, NHS Information Centre, 2008

Perception of health varies by local authority in London but tends to be higher than the national average. In England, 84 per cent of 10 – 15 year olds claimed they were quite or very healthy this ranged from 79 per cent to 95 per cent across London **(Figure 8)**.

Figure 8: Perception of health among 10-15 yr olds in London



Source: TellUs3 Ofsted reports by Local Authority, September 2008

Research shows that parents also have limited awareness of their child's weight status. In a study by Jeffrey et al. (2005), approximately half of obese children were correctly identified as such by their parents but only a quarter of overweight children were correctly identified. Another study (Carnell et al., 2005) in the outer London area of over 500 children attending nursery or reception classes found that only 6 per cent of parents with overweight or obese children identified their child as overweight. This perception was not associated with the parent's age, weight, ethnicity or educational attainment. A larger survey, conducted by National Opinion Poll (NOP), among 1,000 parents with children aged between 4 and 7 years reported that only 14 per cent of parents with an obese child identified that their child was overweight[26].

26 Childhood obesity food advertising in context, National Opinion Poll for Ofcom, July 2004

Healthy eating

In terms of healthy eating, the percentage of young people who say they eat five or more portions of fruit and vegetables a day varies considerably across London, from 14 per cent in Tower Hamlets to 33 per cent in Camden, Kensington and Chelsea and Wandsworth[27]. On average, this reflects the findings of the Health Survey for England which found that among 2-15 year olds on London, 24 per cent of girls and 23 per cent of boys eat five or more portions of fruit and vegetables per day[28].

Children have a good awareness of what foods are healthy and can identify the consequences of not eating healthily however, they do not see it as their role to be interested in health.

> *'All the things that are bad for you are nice and all the things that are good for you are awful'.* (9-10 yr old male)

Children do not see messages about future health as personally relevant or credible. For example, they understand that 'too many sweets can rot your teeth' but they dismiss this because they enjoy the sweet taste and the consequences do not match their actual experience.

> *I like sweets. When I eat it doesn't wobble my teeth'.*

Fruit, vegetables and confectionery have very different meanings for children. Children choose food on the basis of whether they like the taste of it or not. Some children labelled food as 'good' for them if they liked the taste of it rather than considering the health aspect. Food labeled as healthy is more likely to be rejected. Fruit was generally more acceptable than vegetables because it is thought to have a sweeter taste. Colour, taste, texture and size were found to be important to children. Large, hard and leafy vegetables and vegetables with pips in were not well liked (turnip, cauliflower, cabbage and tomatoes). But brightly coloured, small, soft, juicy and sweet vegetables were liked by children (peas, sweet corn and carrots). Children actively seek ways to exercise their own choices with regard to food. They like eating confectionary because they see it as risky, breaking adult rules and a way of asserting their independence. Children also cited throwing away healthy food provided by parents as a way of taking control over what they eat[29].

Children have a powerful voice when choosing their meal. The British Household Panel Survey reports that around 40 per cent of 6-9 year olds chose their evening meal at least half the week[30]. For many families it may be easier and less stressful to let children take a greater role in selecting their own food choices. Food choices can be an important part of being accepted by and belonging to a peer group for children (Birch, 1980) and healthy packed lunches may cause a child to face ridicule.

The percentage of children having school meals has increased slightly between 2008/09 and 2009/10. In primary schools across England 41 per cent of children have school meals, compared with 40 per cent of children in Outer London and 63 per cent of children in Inner London. Children in secondary schools are much less likely to have school meals. Across England, 36 per cent of children

27 *Tell Us 3, Ofsted reports by Local Authority, September 2008*

28 *Health Survey for England, NHS Information Centre, 2008*

29 *Thomas J, Sutcliffe K, Harden A, Oakley A, Oliver S, Rees R, Brunton G, Kavanagh J (2003) Children and Healthy Eating: A systematic review of barriers and facilitators. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London*

30 *The British Household Panel Survey, 2007*

eat a school meal compared with 41 per cent of children in Outer London and 43 per cent of children in Inner London. The average cost of a school dinner is more expensive in secondary schools and also in Outer London compared with Inner London so this could affect take-up[31] **(Table 4).**

Table 4: Average cost of school meals 2009/10

Average cost of school meals 2009/10		
	Primary	Secondary
England	£1.83	£1.94
Inner London	£1.77	£1.89
Outer London	£1.86	£1.99

Source: School Food Trust 2009/10

A survey carried out on behalf of the School Food Trust found that the biggest barrier to children's uptake of school food is poor quality canteens. Children highlighted environmental factors such as cramped canteen layouts, poorly managed queuing systems, inefficient payment methods and high noise levels as the main reasons why they opt out of school dinners[32]. The National Obesity Observatory links obesity prevalence with the eligibility of free school meals, which is also closely linked to deprivation. At a national level, they found that children living in areas with higher rates of eligibility for free school meals, typically areas with higher deprivation levels, have significantly higher obesity rates than those living in areas with low eligibility rates[33]. Providing universal free school meals has been found to have a positive impact on students' eating habits and behavior. Eat Well Do Well, a 3-year study of a universal free meal trial conducted in Hull England, provided free meals and snacks to students. Although the impact of this programme on obesity was not assessed, during the trial, fewer students reported skipping breakfast or eating breakfast on the way to school, going to bed hungry, and drinking soda for breakfast. After three years, more students reported eating school meals, feeling healthy, and making healthier food choices even outside of school. Teachers reported that students had gained nutritional knowledge and were calmer and better behaved[34].

Further work carried out on behalf of the School Food Trust found that London has more fast food outlets per secondary school than any other region in England. There are 28 fast food outlets per secondary school in London, compared with a national average of 23. Inner London has 38 fast food outlets per secondary school compared with 22 in Outer London[35]. American research (Currie et al. 2009) found that having a fast food outlet within close proximity (within 0.1 miles) of a school increases the probability of obesity by 5.2 per cent. There was no significant effect of having an outlet 0.25 or 0.50 miles from a school and the effects of fast food access were found to be greater for girls. The authors concluded that policies restricting access to fast food near schools could have significant effects on obesity among school children. However, UK (Dolton 2009) and Australian (Crawford 2008) research has found little evidence that exposure to fast food outlets in local neighbourhoods increases the risk of obesity. Dolton concludes that in the UK, proximity does not have an impact on childhood obesity and is not related to prevalence. Local level action has been taken in London in areas such as Waltham Forest, where access to fast food outlets has been

31 Take-up of School Meals in England, School Food Trust, 2009/10

32 http://www.schoolfoodtrust.org.uk/news-events/news/canteen-biggest-barrier-to-healthy-eating-for-kids

33 Child Obesity and Socioeconomic Status, National Obesity Observatory, October 2010

34 Evaluation of Eat Well Do Well, Kingston upon Hull's school meal initiative Colquhoun D, Wright N, Pike J, Gatenby L. Hull:The University of Hull; 2008

35 Temptation Town, School Food Trust, 2008

restricted and policies have been introduced in schools to stop children leaving the premises during break times but as yet there is no evidence that this has had an impact on obesity levels.

Planning restrictions relate to new fast food outlets and there is still a need to improve the quality of food on offer in existing takeaways. In December 2009, Environmental Health Officers in 16 London boroughs monitored the buying habits of school children in takeaway queues near 45 local schools. The most popular meals were analysed for salt and fat content. Only four per cent of meals analysed did not fall into the red light labelling category, devised by the Food Standards Agency, which denotes the nutritional content of food[36].

Nationally, almost one-third of youths worry about being healthy, this varies in London from 20 per cent in Camden to 35 per cent in Richmond upon Thames. While three-quarters of young people in London think that the information they currently receive on eating healthy food is good enough, there are still one in five youths who think better information and advice on eating healthily is needed[37].

Levels of physical activity and access to facilities

Forty-one per cent of 11 – 16 year olds travel to school on foot or by bike (44 per cent males, 37 per cent females). This is a slight increase from 39 per cent who walked or cycled to school in 2004. Of those who do not currently walk or cycle, over half (52 per cent) said they wouldn't walk or cycle even if they could because it was too far. Five per cent said they wouldn't walk or cycle because they didn't feel safe[38].

Eighty per cent of young Londoners claimed that they play sport very or quite often (86 per cent males and 73 per cent females). Youths from more deprived areas are more likely to rarely exercise[39]. **Table 5** shows that there are a significant number of 11 to 16 year olds that aren't particularly active:

- Three per cent say that they never do any exercise of 30 mins or more
- Six per cent say they exercise for 30 mins or more less than once a week
- 32 per cent say they exercise for 30 mins or more only one or two times a week.

36 Children's Takeaways Survey, Consensus Action on Salt and Health (CASH), May 2010. http://www.actiononsalt.org.uk/news/surveys/2010/takeaways/index.html

37 Tell Us 3, Ofsted reports by Local Authority, September 2008

38 Young Londoners' Survey, Greater London Authority, 2009

39 Ibid

Table 5: Percentage of 11-16 year olds who exercise for 30 minutes or more

Frequency of exercise	Outside school	Inside school
11 or more times a week	3	4
9-10 times per week	3	3
7-8 times per week	11	8
5-6 times per week	18	16
3-4 times per week	23	22
1-2 times per week	26	34
Once a week	7	9
Less often	6	1
Never	3	2
Mean number of times per week	**3.74**	**3.65**

Source: Young Londoners Survey, GLA, 2009

Data from the Health Survey for England also showed large numbers of 2-15 year olds in England do not participate in any formal sport. Just over half of boys (51 per cent) and 62 per cent of girls had not played any formal sport or taken part in formal sporting activities in the week they were questioned. Only one in three boys and one in four girls in London achieve the recommended level of at least 60 minutes of physical activity everyday[40]. Young people who never play sport said this was because they had other things to do (30 per cent) or they didn't have enough time (22 per cent). Over one fifth (22 per cent) said they just don't want to[41].

A paper on childhood obesity published in 2008 by Boston academics Steven Gortmaker and Kendrin Sonneville investigated the effect of the daily imbalance between energy intake and expenditure – the energy gap – over 18 months. Their experiment showed that when the children exercised, they ended up eating more than the calories they had just burned, sometimes 10 or 20 times as many. Professor Terry Wilkin, of the Peninsula Medical School in Plymouth is completing an 11 year study on obesity in children, entitled Fatness leads to inactivity, but inactivity does not lead to fatness. The study has been monitoring the health, weight and activity levels of 300 subjects since the age of five. When the more naturally active children were compared with the less active ones, no difference in their body fat or body mass was found. The conclusion is not that exercise is not making the children healthy but that it is having no effect on their overall shape and size. This is an important issue to highlight because body mass is currently used as an outcome measure. Wilkin's research also investigated whether it was possible to change a child's physical activity by putting accelerometers on children at schools with very different PE schedules: one which offered 1.7 hours a week, and another that offered nine hours. At the more active school, children did 64 per cent more PE but when they got home they were less active. Those who were less active at school were more active at home so overall the amount of activity carried out by children from both schools was the same. Wilkin concluded that physical activity is controlled by the brain, not by the environment.

Despite the current prevalence, and believed increase in childhood obesity, levels of self reported participation in sports activities and use of green space since 2004 have both increased. The use of green space has increased from 51 per cent in 2004 to 76 per cent in 2009, and participation in sport

40 Health Survey for England, NHS Information Centre, 2008

41 Young Londoners' Survey, Greater London Authority, 2009

has increased from 69 per cent in 2004 to 80 per cent in 2009. Young Londoners are also positive about the long-term benefits of the Olympics, citing that the main benefit will be more children participating in sport (43 per cent) as well as better leisure facilities (25 per cent)[42].

Overall, young Londoners are more positive about the state of their local parks and play areas than youths in other parts of England. The percentage of young people who said their local parks and play areas were poor was lower in every local authority in London than the national average. However, young people in London still feel there is room for improvement as the percentage who felt that better parks and play areas should be a priority to make their area a better place to live ranged from 37 per cent in Richmond upon Thames to 56 per cent in Ealing[43]. Young people like the range of parks and sports facilities available to them in London, with nearly a quarter (23 per cent) of males saying that the range of parks and open spaces is one of the best things about living in London and one fifth of males think that the range of sports and leisure facilities is one of the best things about living in London. Young females are slightly less positive, with 19 per cent thinking that the range of parks and open spaces is one of the best things about living in London and 15 per cent say it is the range of sports and leisure facilities[44].

Over three-quarters (76 per cent) of young people say they very or quite often go to open spaces like parks and nature reserves. Males are slightly more likely than females to go to open spaces more regularly (80 per cent v 73 per cent). Young people who never go to open spaces cited reasons identical to those given for not playing sport - mainly because they had other things to do (33 per cent) or they didn't have enough time (19 per cent) and one-fifth said they just don't want to[45].

Research carried out on behalf of Natural England found that children spend less time playing in natural places, such as woodlands, countryside and heaths than they did in previous generations. Less than 10 per cent play in such places compared to 40 per cent of adults when they were young. Favourite places to play have also changed over time. In the past these were in the streets, near home (29 per cent), indoors (16 per cent) and in some natural places (15 per cent) whereas nowadays children like playing indoors best (41 per cent) and, to a lesser extent, in the garden (17 per cent)[46].

Perception of safety was not specifically mentioned as a barrier to visiting open spaces or playing sport in the Young Londoners' Survey but 15 per cent said they do not feel safe in their own neighbourhood (12 per cent males, 18 per cent females). Their biggest fears are of knife crime (27 per cent), teens hanging around on the streets (22 per cent) and being mugged or physically attacked (22 per cent). Young Londoners tend to feel more unsafe in their local neighbourhoods and going to and from school than youths in other parts of England[47].

42 Young Londoners' Survey, Greater London Authority, 2009

43 Tell Us 3, Ofsted reports by Local Authority, September 2008

44 Young Londoners' Survey, Greater London Authority, 2009

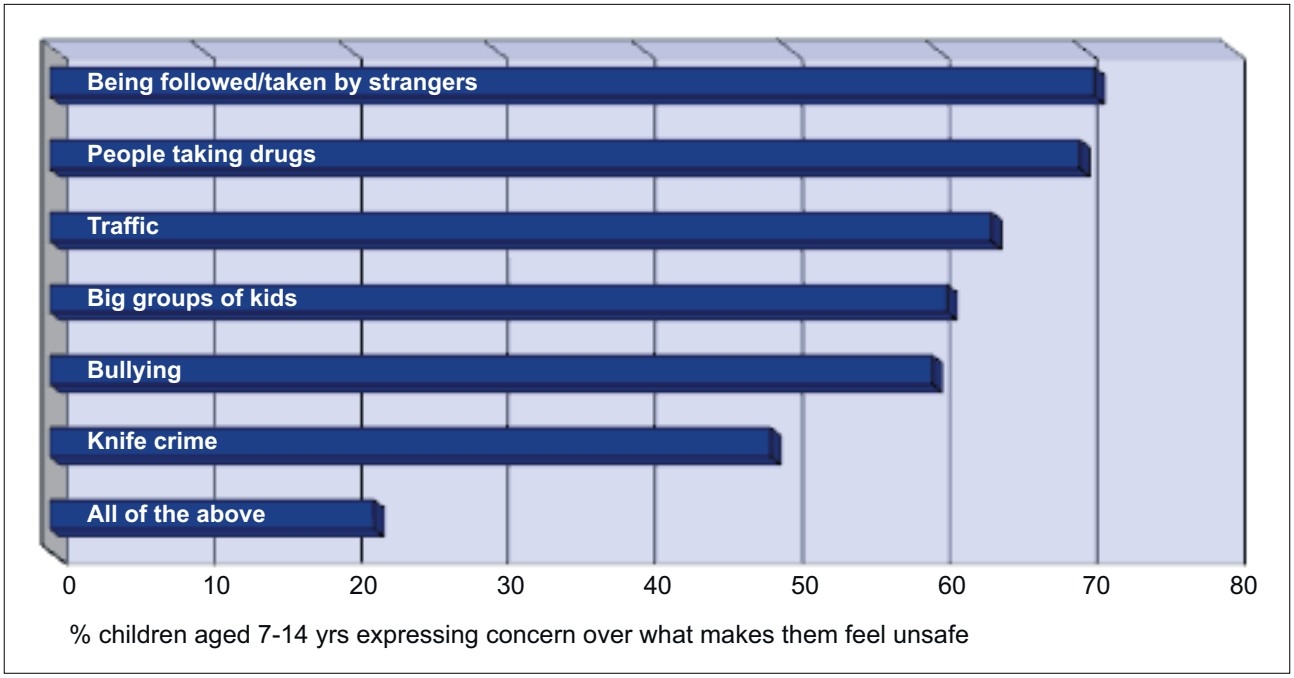
45 Ibid

46 Childhood and Nature: A survey on changing relationships with nature across generations, Natural England, 2009

47 Young Londoners' Survey, Greater London Authority, 2009

In research carried out on behalf of Playday, safety was raised as a key concern among children; 48 per cent of 7-10 year olds and 30 per cent of 7-14 year olds feel unsafe playing outside without an adult. The main worry, causing more concern than seeing people taking drugs, is being followed or taken by strangers in their neighbourhood[48] **(Figure 9)**.

Figure 9: Reasons for feeling unsafe playing outside in local area



Source: Playday July 2010

The majority of children (over 70 per cent) say they are supervised wherever they play, this rises to over 80 per cent in natural places. Parents would like their children to be able to play in natural spaces unsupervised (85 per cent) but fears of strangers and road safety prevent them from giving much freedom to their children. Children would like more freedom to play outside (81 per cent). Nearly half of the children say they are not allowed to play outside unsupervised and nearly a quarter are worried to be out alone. As well as the perception of safety, 29 per cent of children think that adults disapprove of them playing outside where they live. Older children in particular feel discriminated against or negatively judged by adults – one of four children had been told off for playing ball games in their neighbourhood[49].

48 Our Place, Playday, 2010

49 Our Place, Playday, 2010

3. The effectiveness of childhood obesity interventions

Overview

McCormick et al. (2007) show evidence that lifestyle patterns of food consumption and exercise are set early in life. Research conducted by proponents of the Mind, Exercise, Nutrition…Do it (MEND) programme (MEND 2010) suggest that childhood obesity is a leading predictor of obesity in adulthood and tackling the obesity problem requires intervention at an early age. Once children become overweight or obese, they are also less likely to exercise due to a lack of confidence, health difficulties or poor performance. This will make it more difficult to lose weight and will further exacerbate the problem.

Measures to address obesity can be thought of as falling into three broad categories:

- "Weight management programmes" targeted at individuals *who are already overweight or obese,* with the intention of helping them reduce or manage their weight;
- Preventative interventions; and,
- Wider prevention activity, particularly focussing on environmental factors such as the built environment, availability of services, and food systems.

For the most part this analysis considers the first two intervention types. Obesity prevention programmes need to address a range of complex factors if they are going to be effective in modifying behaviour. The main aspects of obesity prevention or reduction programmes include education, nutrition advice, behaviour change programmes, physical activity, and parental development.

While a number of programmes to target obesity have been implemented in the UK and internationally, relatively few have been systematically and effectively evaluated. In particular, there is little robust evaluation evidence that considers both the costs and benefits of childhood obesity interventions. A review of evaluation literature has found very few attempts at cost benefit analysis and cost-effectiveness analysis, although the latter has been attempted in more cases[50]. Indeed the relatively recent NICE guidance on obesity identified, "… a paucity of data on the cost effectiveness of interventions, particularly interventions undertaken in the UK and with more than 1-year follow-up"[51]. In order to find evidence of what is effective in addressing childhood obesity it has been necessary to look internationally to countries where programmes have been evaluated using cost-benefit or cost-effectiveness analysis.

Some of the interventions that have been included in this review are somewhat broader than just programmes focussed specifically on child obesity. This is because of the lack of robust evaluation evidence, and the possible insights that could be gained through looking at interventions that may provide positive impacts on obesity in addition to their core goal. For example, active transport programmes are primarily introduced from a transport perspective but may also have impacts on health and other external costs such as pollution and congestion. A list of the evaluation studies that have been reviewed for this paper have been included in Annex 7 at the end of this paper.

Consequences of childhood obesity

Childhood obesity is associated with significant psychological and physiological health problems. Obesity has been linked to low self-image, low self-confidence and depression in some obese children, even at a very young age (POST, 2003). The risk of these psychological problems developing

50 In health studies, cost-effectiveness is more common than cost-benefit analysis and it generally compares the incremental cost per quality-adjusted life year (QALY)

51 Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children; December 2006, NICE – Section 6 Health Economics

increases with age, and this is particularly the case for girls. Evidence also suggests that obese children have a greater propensity to become obese adults later in life. POST (2003) asserts that overweight adolescents have a 70 per cent chance of becoming overweight or obese adults. This increases the risk of developing a range of chronic diseases such as diabetes and coronary heart disease. Table 6 illustrates some of the complications associated with childhood obesity.

Table 6: Complications of childhood obesity

Complications of childhood obesity	
Psychosocial	Poor self-esteem, Anxiety, Depression, Eating disorders, Social isolation, Lower educational attainment
Neurological	Pseudotumor cerebri
Endocrine	Insulin resistance, Type 2 diabetes, Precocious puberty, Polycystic ovaries (girls), Hypogonadism (boys)
Cardiovascular	Dyslipidemia, Hypertension, Coagulopathy, Chronic inflammation, Endothelial dysfunction
Pulmonary	Sleep apnea, Asthma, Exercise intolerance
Gastrointestinal	Gartoresophageal reflux, Steatohepatitis, Gallstones, Constipation
Renal	Glomerulosclerosis
Musculoskeletal	Slipped capital femoral epiphysis, Blount's disease, Forearm fracture, Back pain, Flat feet

Source: Ludwig, D. 2007. Childhood Obesity – The Shape of Things to Come

These consequences are all costly to treat and reduce the quality of life of individuals. Therefore prevention or intervention to reduce the prevalence of childhood obesity is imperative to improve longer term health outcomes.

Case for government intervention

While the costs of obesity are significant, some have argued that government intervention to tackle obesity is neither justified nor desirable (McCormick et al. 2007). In order for the government to intervene there must be a rationale in terms of equity or the existence of a market failure. The main case proposed for intervening in the area of child obesity is that food, or weight more generally, could be regarded as a type of demerit good in which (at least some) individuals are unable to be an optimal judge of their own welfare (McCormick et al. 2007). It can also be argued that some individuals may exhibit time inconsistent preferences towards obesity by choosing instant gratification and future harm. This is particularly the case for children who do not have the longer term foresight to consider that the food and exercise choices they are making now, may have negative impacts in the future. When considering interventions, it is important that government actions provide greater benefits to society than in the absence of the interventions. It is also important that public sector's resources are used as efficiently as possible by considering the cost-effectiveness of programmes.

Interventions to address obesity

Sassi (2010) found that most Organisation for Economic Co-operation and Development (OECD) countries have recognised the problem of obesity and that governments have started implementing a number of initiatives to address the problem. The main interventions involve the promotion of a culture of healthy eating and active lifestyle. This was often encouraged at a young age through changes in the school environment regarding food and drink, and improvements in the facilities for physical activity. In addition to this, there have been several campaigns to disseminate nutrition guidelines and health promotion messages, as well as promoting active transport and active leisure.

Governments have generally refrained from using regulation and fiscal levers because of the enforcement costs and implications for key industries. While Sassi noted that prevention of obesity is preferred over other methods to treat the condition, interventions aimed at children can take a long time to make an identifiable impact on people's health and thus obtain favourable cost-effectiveness ratios.

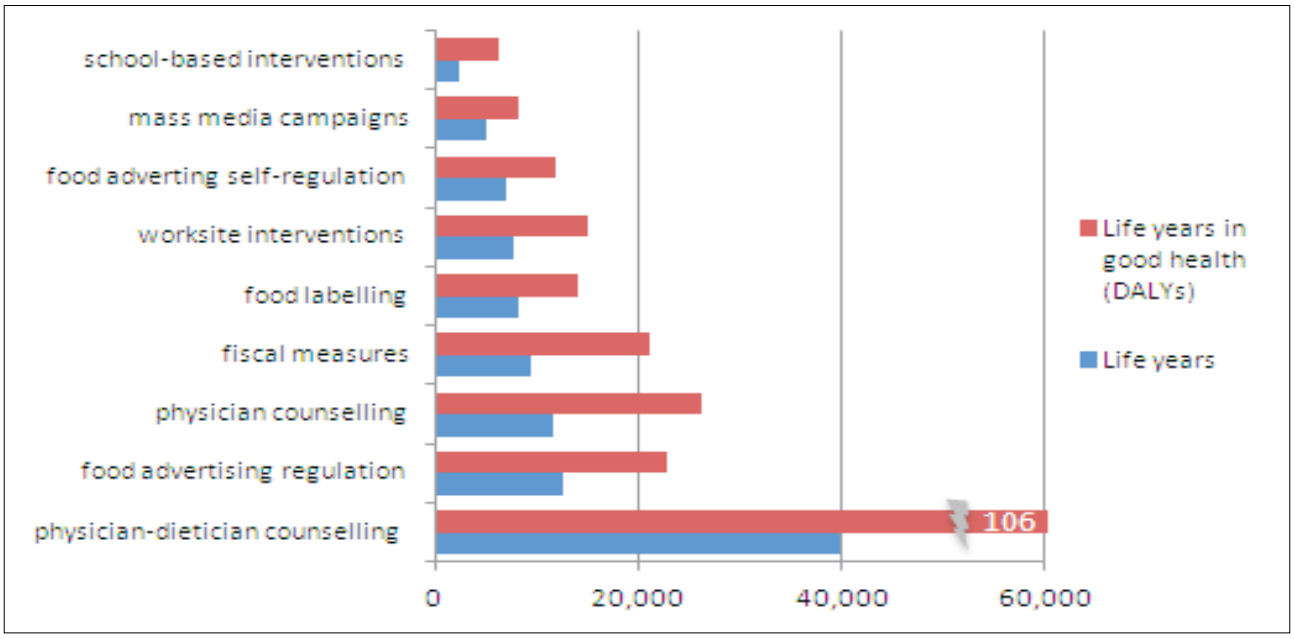
Cost-effectiveness of childhood obesity programmes

A literature review revealed that there are few examples of child obesity programmes that have been subject to economic evaluation. Clinical studies can show what interventions are effective in terms of weight loss and improved health outcomes[52], but they do not provide insights into which programmes offer the best value for money. To do this, it is necessary to look at studies that include cost-benefit analysis or cost-effectiveness analysis. Due to the lack of available evidence it was necessary to look internationally, particularly to other OECD countries such as Australia and the US where some of these studies have been undertaken.

The evaluation evidence shows that the cost effectiveness of childhood obesity programmes varies widely. A recent study conducted by the OECD, "Obesity and the Economics of Prevention: Fit not Fat" (2010) considered the health outcomes of a range of interventions based on additional life years in good health (DALYs[53]). It should be noted that the conclusions from this work are based on modelling of similar (though not exactly the same) interventions in different OECD countries (and such interventions are not limited to interventions aimed at children). The analysis also acknowledges, as noted earlier, that there is a paucity of evidence in many areas (necessitating a number of assumptions in the modelling). In addition, the number of intervention types considered is limited due to the need to find similar interventions across countries and due to the lack of robust data.

Accepting these limitations, the study found that physician-dietician counselling had the greatest impact on health outcomes, followed by physician counselling and food advertising regulation **(Figure 10)**.

Figure 10: Health outcomes at the population level (average effect p.a.)



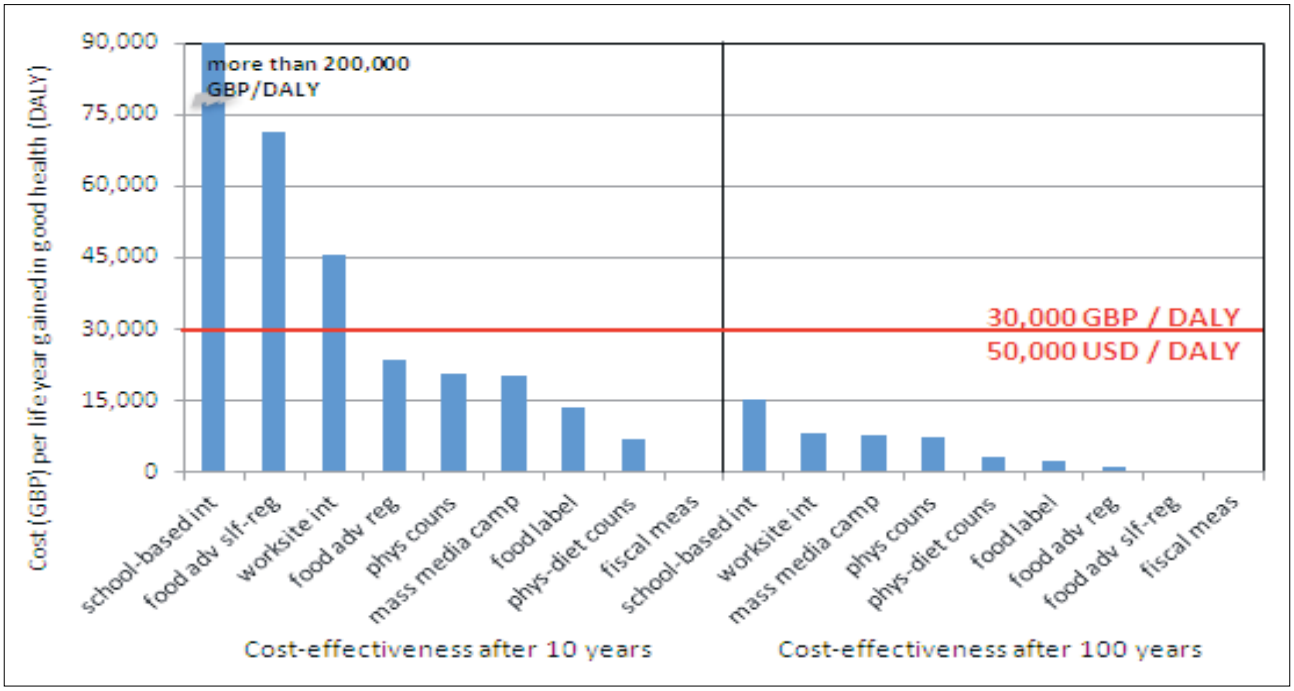
Source: OECD. 2010. Obesity and the Economics of Prevention: Fit not Fat

52 *For instance a relatively recent Cochrane Review assesses the effectiveness of interventions designed to prevent obesity in childhood through diet, physical activity and/or lifestyle and social support*

53 *Disability Adjusted Life Years – a measure of additional life years in good health*

In terms of cost-effectiveness, the OECD found that prevention can improve health at a lower cost than many other treatments offered. All of the prevention programmes reviewed were cost-effective in the long run, but some take a longer time for the health effects to be realised. **Figure 11** shows the cost per life year gained for each of the intervention types, relative to the English threshold for cost effectiveness of £30,000.

Figure 11: Cost per life year gained in good health of interventions to tackle obesity



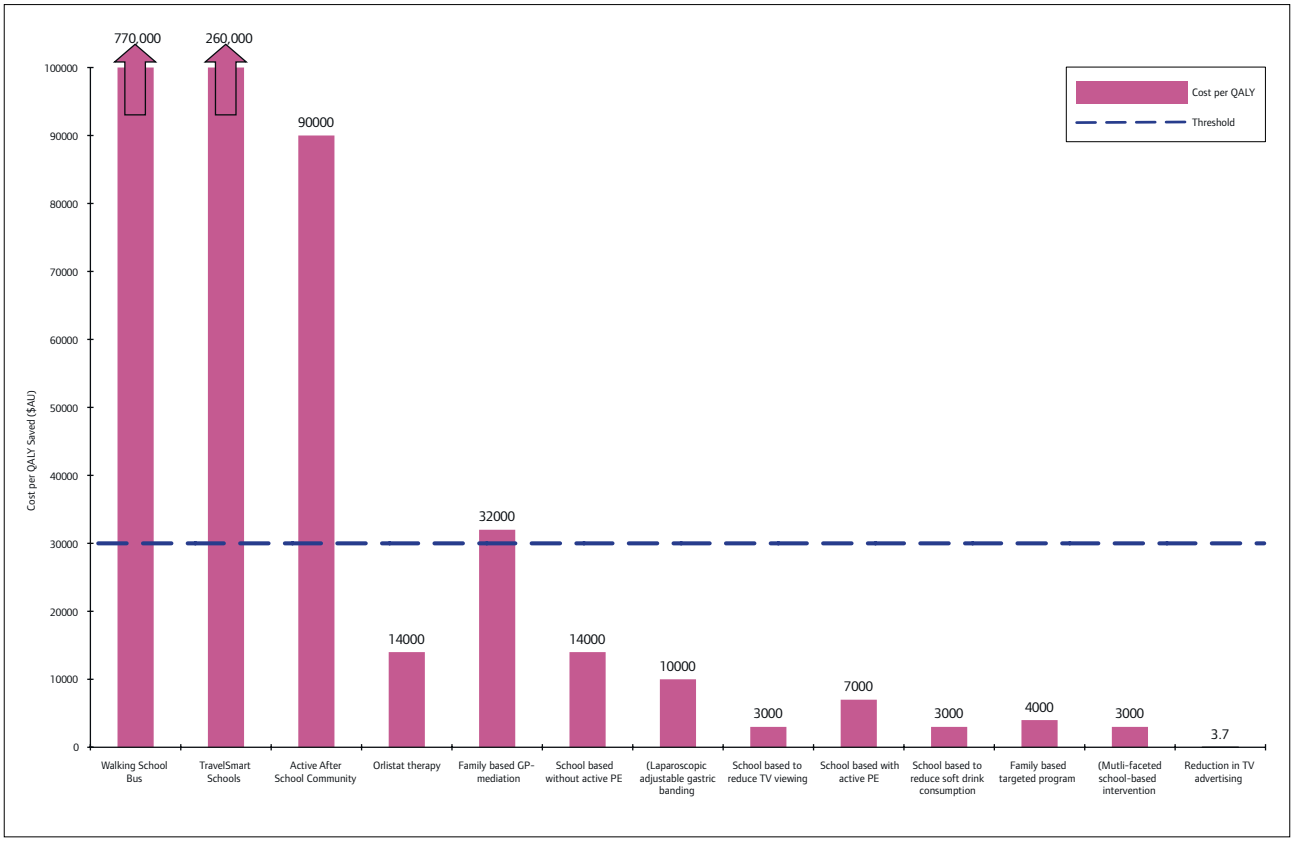
Source: OECD. 2010. Obesity and the Economics of Prevention: Fit not Fat

Figure 11 shows that fiscal measures were found to be the most cost effective, followed by physician-dietician counselling and food labelling. School based interventions proved to be the least cost-effective when evaluated over 10 years, followed by food advertising self-regulation and worksite interventions. The cost effectiveness of the school based interventions improved significantly when evaluated over 100 years. This is because the benefits may not be apparent immediately, but accrue over the life-time of the child. More generally the work finds that when interventions are combined in a multiple intervention strategy, targeting different age groups and determinants of obesity simultaneously, overall health gains are significantly enhanced without any loss in cost-effectiveness.

Prior to the OECD report, the most comprehensive study of the cost-effectiveness of obesity interventions came from Australia. The Victorian Government Department of Health Services (2006) evaluated thirteen different child and adolescent obesity programmes on a consistent basis[54] and found that the incremental cost effectiveness ratio ranged from just AU$3.70 per DALY saved to AU$770,000 per DALY saved. The incremental cost effectiveness ratios (ICER) for each of the interventions in the study have been illustrated in **Figure 12** opposite, compared with the threshold for cost-effectiveness which is AU$30,000. Interventions with an ICER below the threshold are considered to be cost effective.

54 The overall benefit of each intervention was evaluated in two stages. First, the health benefits were measured in terms of disability adjusted life year saved (DALY) which incorporates changes in mortality and morbidity. An incremental cost-effectiveness ratio is then calculated as the incremental cost (AU$) per incremental disability adjusted life year saved

Figure 12: Cost effectiveness of youth obesity interventions in Australia



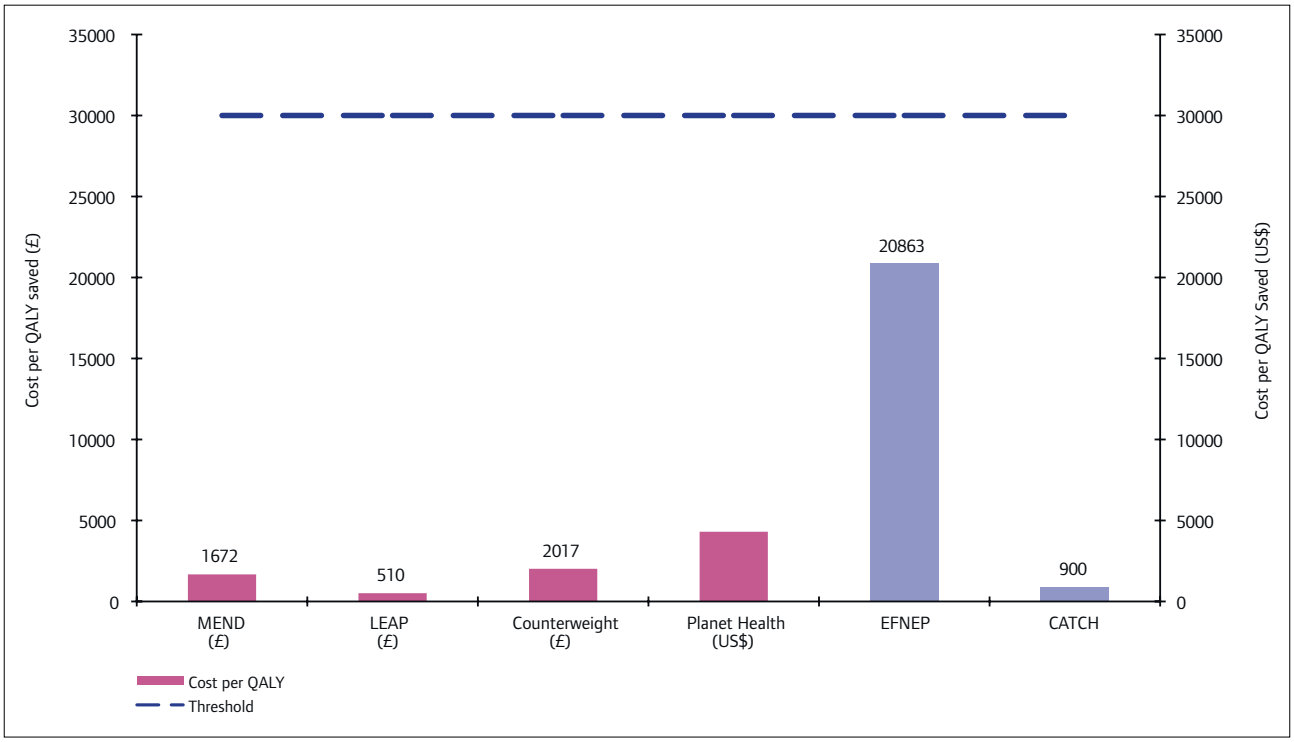
Source: Victorian Government Department of Human Services (2006) "ACE-Obesity: Assessing Cost-effectiveness of obesity interventions in children and adolescents".

Figure 12 shows that the majority of interventions considered were cost-effective in reducing obesity. However, four programmes were not cost-effective and three of these were significantly over the £30,000 cost-effectiveness threshold. These were all school-related programmes to increase child activity. Walking school bus had an ICER of AU$770,000 per DALY saved; TravelSmart Schools had an ICER of AU$260,000 per DALY saved and Active After School Community Programme had an ICER of AU$90,000 per DALY saved. The most cost-effective programmes were related to TV advertising of high fat/sugar content food and drinks aimed at children (AU$3,70 per DALY saved); school-based programmes to reduce TV viewing (AU$3,000 per DALY saved) and a school-based programme to reduce the consumption of sweetened, carbonated beverages (also AU$3,000 per DALY saved). Another multi-faceted school programme targeted at overweight or obese children proved to achieve this same level of cost-effectiveness. This study has clearly demonstrated the variation in cost-effectiveness of achieving obesity outcomes between different interventions.

In addition to these two studies, individual evaluation evidence from the UK and US was found for another seven interventions. All of these were cost effective when compared with the UK threshold from NICE of £20,000-£30,000 per quality adjusted life year[55] (QALY) saved and the US threshold of US$30,000 per QALY saved.

55 *The quality adjusted life year (QALY) method takes into account several factors so that different interventions or programmes for the same conditions can be compared. A QALY gives an idea of how many extra months or years of life of a reasonable quality a person might gain as a result of a programme or intervention. The cost per QALY provides a common measure by which to assess cost-effectiveness for any intervention as the cost per 'extra year' can be calculated*

Figure 13: Average cost effectiveness of obesity interventions in children and adolescents in the UK and US



Source: Techankehakij et al. 2010, Policy Exchange 2008, Trueman et al 2010, Trueman et al 2006, Wang et al. 2003, Dollahite et al 2008 and Cawley 2010

Figure 13 shows that the seven obesity interventions considered here are clearly cost-effective when compared with the general guidelines for cost-effectiveness. The relative cost effectiveness is not directly comparable between the programmes because they have not been evaluated in the same way, and the evaluations from different countries have presented their ICER results in different currencies[56]. However, this chart does give us a clear indication that the programmes are cost effective in achieving improved health outcomes.

In addition, NICE have produced guidance on the prevention, identification, assessment and management of obesity in adults and children. In developing the guidance a consideration of the evidence around the cost-effectiveness of obesity interventions was made[57]. That work identified a paucity of data on the cost effectiveness of interventions, particularly interventions undertaken in the UK and with more than 1-year follow-up. However, notwithstanding the limited evidence, the work on health economics for the NICE guidance found that 'non-pharmacological' interventions (mainly interventions around diet, behavioural and physical exercise) appeared to be a cost-effective use of resources.

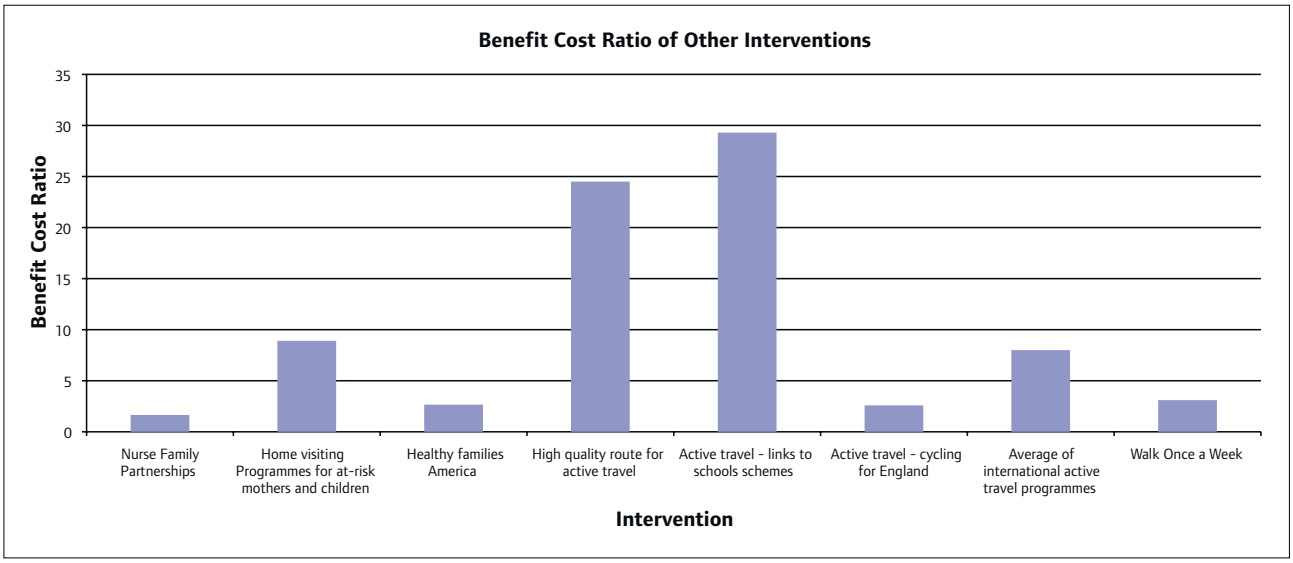
In addition to these cost-effectiveness studies, some cost benefit analysis has been conducted of other programmes that may contribute to a reduction in childhood obesity (Figure 14). These interventions were not designed specifically as childhood obesity reduction programmes, but may have the additional impact of improving the health of children. The interventions consist of early years programmes aimed at improving parenting skills and the overall health of children, and active

56 Note that the UK studies are red and the US studies are blue in Figure 5

57 Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children; December 2006, NICE – Section 6 Health Economics

transport programmes to encourage children and adults to walk and cycle as modes of transport. These programmes have not been evaluated in terms of their impact on obesity outcomes so it is not known to what extent they actually do impact on child obesity.

Figure 14: Benefit cost ratios of other interventions



Source: Aos et al. 2004 adjusted by GLA Economics, Davis 2010

The early years interventions included here have not specifically been evaluated in terms of childhood obesity outcomes, but they do have other positive related outcomes in terms of parenting skills, breastfeeding rates and information on raising healthy children. Examples of effective early years interventions include Nurse Family Partnerships, Healthy Families America, and Home visiting programmes for at-risk mothers and children. Skouteris et al. (2010) suggests that effective prevention and intervention programmes for children in their pre-school years are an important step in overcoming the obesity problem. This is because eating and physical activity habits become established during these early years and development at this time is more malleable than in later childhood. Parents are the primary influence on children of pre-school age, so it follows that programmes that teach healthy parenting have the potential to significantly improve the child's well-being later in life.

GLA Economics (along with the Children and Young People's Unit at the Greater London Authority) published Early Years Interventions to address Health Inequalities in London – the Economic Case in January 2011. This document translates the cost-benefit analysis of evidence-based US programmes to UK values and provides more information on specific interventions and general characteristics of programmes which improve outcomes for families[58].

Some active transport programmes have received very high cost benefit ratios[59], but because obesity reduction has not been the primary outcome evaluated it is not known how much of an impact these programs will have on reducing the prevalence of childhood obesity. The examples of active transport programmes that have been evaluated in terms of obesity outcomes (for example, Walking School

58 *Further information can be found on the website at: http://www.london.gov.uk/who-runs-london/mayor/publication/early-years-interventions-economic-case*

59 *Note the results of these active transport schemes are appraisals rather than evaluations, so they are based on modelled expectations of outcomes rather than an evaluation of actual observed outcomes. Evidence shows that there is often an "optimism bias" in appraisals that results in an over-statement of the benefit cost ratio*

Bus and TravelSmart Schools) have not been cost effective in terms of cost per QALY saved. Therefore, these projects may have the potential to provide significant benefits to society overall[60], but they may not necessarily be effective for addressing childhood obesity.

Cost effective childhood obesity programmes

From the programmes that have been evaluated, the cost-effectiveness of child obesity programmes varies quite considerably. While most appear to be cost effective, there are also a number of programmes that are not considered to be cost effective. This section will describe some interventions that appear to be cost effective based on evaluation evidence[61].

Mind, Exercise, Nutrition … Do it!

Mind, Exercise, Nutrition…Do it! (MEND)[62] is a community based programme developed with the Great Ormond Street Hospital for Children and the University College London Institute of Child Health. The programme has been implemented throughout England. It aims to help children and their families become fitter, healthier and happier by offering free healthy living programmes in the local community. There are a suite of MEND programmes available, targeted at different age groups; however, most of the evaluation evidence comes from the MEND7-13 programme.

The evidence shows that the MEND programme is cost effective in improving child obesity outcomes. The key reasons cited for the success of the programme include: the involvement of both children and parents; high participation and attribution rates; the combination of nutrition education and physical activity; and its community based delivery which is accepted, non-stigmatising and low cost. The result of the economic evaluation (ICER of £1,672 per QALY) is based on the assumption that the results of a randomised controlled trial could be applied to all eligible children across England[63].

Local Exercise Action Pilots

Local Exercise Action Pilots (LEAP) were implemented with the aim of increasing regular, moderate physical activity of the general population, including people from priority groups, and to reduce the number of sedentary adults and children. Each site piloted one or more interventions including: exercise referrals; classes and groups; motivational interviewing; peer mentoring; campaigns and directories; outdoors and transport; training leaders and co-ordinators.

The cost per QALY saved ranged from about £50 to £510 depending on the interventions, which is well below the NICE threshold of £30,000 for cost-effectiveness. However, the evaluation was not able to determine specifically what the most effective interventions were. While this information is useful, it is important to note that the results are based on quite small sample sizes so they may not

60 *The main benefits attributed to these active transport programmes include congestion reduction, productivity gains, pollution reduction, improved ambience and life years saved (this relates to general health benefits and a reduction in road traffic casualties). It does not consider benefits in terms of reduced morbidity (ill-health) or its impact on obesity specifically.*

61 *There is a difference between cost-effective and cost-saving. Cost effective refers to whether the cost per pre-defined outcome (eg Quality Adjusted Life Years) of an intervention is lower than an acceptable threshold. Cost saving refers to whether, overall, the total costs of the programme are less than the total benefits. Due to the method in which childhood obesity programmes are typically evaluated, cost effectiveness is referred to here. This is a lower threshold than cost-saving.*

62 *For more information about MEND see: http://www.mendprogramme.org/home*

63 *This may not be a realistic assumption because currently more than half of participants are self-referred (then randomly allocated to the programme or a control group) so the sample may be biased. That is, it may include people who are more likely to participate in the programme because they have more motivation to lose weight than people who have not actively sought participation in a programme*

necessarily be representative of the larger population. The key recommendations from the LEAP evaluation to delivery agents were that interventions should be pre-planned to assess, and then meet the needs of participants; staff with a suitable range of skills for promoting physical activity with priority groups should be recruited; community groups and individuals should be involved as this helps to engage priority groups; and physical activity should be promoted within a strategic framework.

Planet Health

Planet Health[64] is a school-based intervention focusing on the promotion of good health rather than on weight. It teaches children how to incorporate healthy eating and regular physical activity into their lives, and to limit screen time. The programme is for all children, not just those who are already overweight. The developers of the programme identified schools as a key setting for public health strategies to prevent obesity because schools have many opportunities to engage children in healthy eating and physical activity and to teach and reinforce healthy diet and physical activity messages. The evaluation by Wang et al. (2003) calculated a cost of US$4,305[65] per QALY saved and a net saving to society of US$7,313 to society. Ganz (2003) notes that this cost per QALY is less than many adult treatments, providing evidence that early prevention and intervention are better than later treatment.

Coordinated Approach to Child Health

Coordinated Approach to Child Health[66] (CATCH) began as a research study in the US to determine the effectiveness of school physical education and health programmes. The programme is for children from preschool to grade 8 and is a coordinated programme designed to promote healthy food choices and physical activity and prevent tobacco use. It is now being implemented in over 7,500 schools and after-school programmes across the US and Canada. An evaluation study has shown that the cost of the programme is US$900 per QALY saved, which is considered to be cost-effective. One of the reasons for its success is its coordinated approach involving the school, home and community environments.

Reduction in television viewing

This is a school-based health promotion programme, specifically aimed at reducing television viewing. The evaluation was conducted in the Australian A-C-E study, but the programme is based on Bandura's social cognitive theory which was trialled in grade 3 and 4 children in a randomised controlled trial in the USA. The programme is delivered by regular classroom teachers over a period of six months. It includes classes about intelligent TV viewing, a television turn-off challenge for 10 days and encouragement to follow a 7-hour a week television budget. Educational newsletters are also sent to parents, providing them with strategies for limiting TV use. The evaluation found that the intervention is cost-effective in reducing unhealthy weight gain in children aged 8 to 9 years over one academic school year. The cost per DALY[67] saved was AU$3,000[68].

64 For more information see: http://www.planet-health.org/

65 In the US, interventions with a cost of less than $30,000 per QALY saved are generally considered to be cost-effective

66 For more information see: http://catchinfo.org/index.asp

67 Australian studies refer to DALY (Disability adjusted life years) rather than QALY (Quality adjusted life years) as in UK and US studies. The concepts are generally similar

68 The threshold for cost-effectiveness in Australia is AU$30,000 per DALY

Regulation of television advertising
This Australian programme focuses on reducing television advertising of high fat and/or high sugar foods and beverages and fast food directed at children up to the age of fourteen. It will affect regulation to preclude advertising of these products within specific timeframes (7am to 8am and 3pm to 9pm Monday to Friday and 6am to 1pm on Saturday and Sunday). The evaluation evidence is based on a randomised controlled trial assessing food choices after reduced advertising, which showed similar positive results to advertising bans that exist for toys, smoking and alcohol. An actual widespread ban of high fat and/or high sugar foods and beverages has not yet occurred. While evidence from smaller trials show that it could be a cost effective intervention for government, it would likely face significant opposition from advertisers and would require significant political support.

Multi-faceted school-based interventions
A number of multi-faceted, school-based interventions were found to be cost-effective. They include a combination of education and physical activity components, and encouragement of healthy food and lifestyle choices. One of the programmes was targeted specifically at overweight and obese children who were provided with individual peer support from a well-liked older student. The other programmes were provided for all students by regular teachers with the involvement of parents strongly encouraged. School based programmes can be an effective way to encourage healthy eating and increased activity across the child population.

Medical interventions
While some medical and surgical interventions, such as Orlistat therapy and laparoscopic adjustable gastric banding, appeared to be cost-effective in the Australian A-C-E study they are considered to be outside the scope of this paper. This is because such medical treatments are outside the Mayor's remit; and the focus of this paper is on more universal interventions and prevention programmes. They have been included here for comparison purposes.

Characteristics of effective programmes

Through the analysis of effective programmes, it has been possible to identify some common characteristics that have been evident in successful interventions. These include family and community involvement, early intervention, and particular aspects of programme structure and delivery. Cost-effective programmes are either successful because they are able to reach a large population of individuals, or because the impact on each individual is substantial.

Parental involvement
From the evidence, it is clear that involving parents as well as children can have significant impacts because of the role parents play in influencing children's food and activity choices (Moran, 1999). Skouteris et al. (2010) assert that preschool programmes should be family based because the primary social force that influences young children's health behaviour and development is the parent. Further to this, Doak (2006) found treatment studies that show that family-based interventions combining education with behaviour modification are the most successful. A child's lifestyle, environment are directly determined by care-givers through food selection, home eating patterns, meal structure, responsiveness to a child's feeding cues and general parenting styles (Doak, 2006).

Dietary and physical activity programmes
Evidence on whether dietary or physical activity interventions are more effective is mixed, but many of the successful interventions include both aspects. Kain et al. (2004) found that boys, in particular, appear to respond better to programmes that have a physical activity focus. Interventions that limit

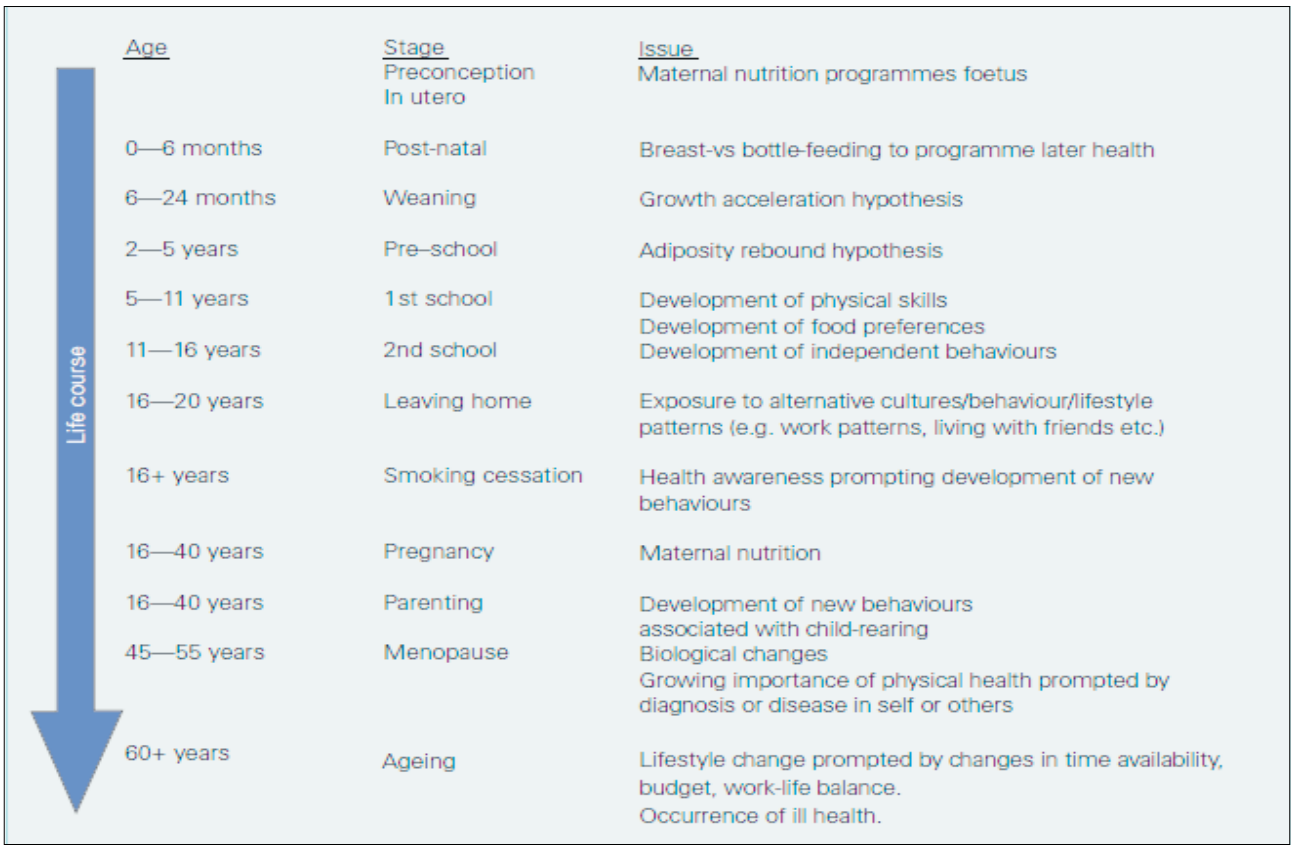
television viewing or "screen time" are often effective in reducing BMI due to the relationship of these factors with sedentary lifestyle. Many of the successful programmes were focussed on promoting a healthy lifestyle rather than specifically on reducing weight, so included a combination of nutrition education, physical activity and encouragement to change behaviour in the longer term.

Early years programmes

Intervention in the early years is important for developing the behaviour and cognitive patterns that will be set for later in life. Skouteris et al. (2010) argue that targeting preschool aged children is central to preventing obesity. This is because development at this life-stage is more malleable than it is later in childhood and adolescence, and risk factors of excess weight can be more easily modified. Medical evidence also suggests that diet in infancy can impact on a child's longer term health. For example, breastfeeding of infants at an early age tends to be associated with a lower prevalence of obesity later in life and provides significant health benefits for both mothers and babies (SIGN, 2010; NHMRC, 2003). Therefore, cost-effective early years programmes that promote breastfeeding may also have longer term benefits for obesity.

The Foresight report (2007) identified a number of critical opportunities for intervention during an individual's life course. As can be seen in Figure 15 below, many of these critical opportunities are in the early years of life or directly influence the early years of life through pregnancy and parenting. If balanced, healthy meals and regular activity are encouraged from a young age, the early years provide an important opportunity to establish healthy lifestyle behaviours to prevent obesity in the future.

Figure 15: Critical opportunities for intervention during the life course



Source: Foresight, 2007

Programme delivery

One of the key reasons attributed to the success of MEND is that is a community based programme. It provides a clinically effective programme through people in the local community. This improves the acceptability of the programme, reduces stigmatisation and improves cost-effectiveness. This has also been identified as a reason behind the very high participation and attrition rates of the intervention. When delivering a child obesity programme it is important to ensure that the target participants are engaged successfully and that programmes are culturally sensitive and appropriate for their needs. In particular, programmes that are fun and actively involve children and parents are more likely to be successful. Simonetti D'Arca et al. (1986) found that a multimedia programme that involved distributing printed material, audiovisuals and discussion meetings with families and teachers to be effective; while the same programme using only printed materials was not effective. This shows that providing information alone is not sufficient to engage participants and achieve positive outcomes.

Childhood obesity programmes that are not cost effective

The evaluation evidence has also identified some interventions that have not been effective in achieving obesity outcomes. It is recommended that future investment be directed towards programmes that are proven to be successful rather than ones where there is limited evidence of effectiveness. TravelSmart Schools, Walking School Bus and Life-style counselling by GPs are some examples of interventions where there is little evidence to support cost-effective childhood obesity outcomes.

TravelSmart Schools and Walking School Bus

While TravelSmart Schools and Walking School Bus have been cited as an innovative travel to school programmes, there is little evidence to suggest that they are effective in achieving child obesity outcomes in a cost-effective manner. In particular, the increase in walking to school has failed to result in reductions in BMI. The cost per DALY saved of TravelSmart Schools is AU$260,000 and the cost per DALY saved for Walking School Bus is AU$770,000. These are both well above the threshold of AU$30,000 for cost-effectiveness[69].

Haby et al. (2006) consider it not to be surprising that active transport programmes have a smaller effect than nutrition interventions, such as reducing fizzy drinks. This is because, for the average 8 year old child, 10 per cent of energy intake is equivalent to 450mL of soft drink (just over one can) whereas 10 per cent of energy expenditure is equivalent to 2.5 hours of extra walking (Swinburn et al. 2006). This does not mean that physical activity is not a worthwhile pursuit; it shows that a certain level of intensity and duration is required to have a measurable impact.

Active After-School Community Programmes

The Active After-school Communities program is an Australia-wide initiative that provides primary school-aged children with access to free sport and other structured physical activity after school from 3.00pm to 5.30pm. The program aims to engage traditionally inactive children in sport and other structured physical activities. As a result of their positive experience, it is anticipated that they may then join a local sporting club in the future. Whilst a considerable amount of money was invested into the programme, there was no evidence of any significant improvement in child obesity outcomes.

69 A limitation of cost-effectiveness analysis compared with cost-benefit analysis is that it only considers the costs with respect to a particular outcome (in this case DALY). While this is useful for comparing similar programmes that are directed towards the same outcome, it does not allow other positive (or negative) benefits to be captured. For example, the travel to school programmes may have significant benefits in terms of congestion reduction and lower carbon emissions that have not been considered. However, it is clear from the cost-effectiveness analysis that these interventions should not be implemented on the grounds of obesity reduction alone

Life style counselling by GPs

The OECD study found that physician-dietician counselling was very effective in addressing obesity for adults. However, this is in direct contrast to a study conducted by Higgs (2010) who evaluated a programme where GPs identify cases of childhood obesity and then undertake necessary counselling. Higgs found that the costs of GPs were very high and that counselling has not been effective in terms of BMI, nutrition improvements or physical activity in children classed as overweight or obese. It may well be the case that physician counselling is effective in addressing obesity in adulthood (as was the focus of the OECD study), but less effective in overcoming childhood obesity.

Characteristics of ineffective programmes

From the evidence reviewed, some characteristics that have been identified in less successful interventions include: an insufficient intensity of some physical activity programmes; a failure to adjust for cultural sensitivities; poor engagement with target audiences which results in low participation and retention rates; lack of involvement with parents, families and communities; clinical programmes that are expensive and/or stigmatising; and walk to school programmes which do not appear to provide sufficient health impacts to improve BMI scores.

Other factors to consider

As noted earlier, measures to address obesity can be thought of as falling into three broad categories: measures targeted at individuals *who are already overweight or obese;* preventative measures; and, wider measures. This section briefly considers some other factors that might arise when considering one of these intervention types.

Unintended consequences

Interventions targeted at improving the health and well-being of overweight and obese children could have other unintended consequences (either positive or negative). For example, interventions that are provided in a school based setting may have a negative impact on underweight children who feel as though they also need to lose weight. It could also be argued that a school curriculum focused more heavily on physical activity and nutrition education activities could have detrimental impacts on other academic achievements[70]. Each of these other consequences should be considered to ensure that its objectives are being met without causing other detrimental impacts.

Costs and funding

In a time of constrained budgets, the costs of introducing new programmes and interventions are likely to be an issue. Therefore, funding should be directed to programmes that are proven to provide positive outcomes. There may also be other cost and sustainability issues specific to some interventions that need to be considered. For example, if a school was to introduce new products for their lunches such as perishable fruits, this may have cost implications in terms of waste that were not previously encountered. It is important to be cognizant of these additional costs when designing new policy or programmes.

Recruitment

The review conducted by Upton et al. (2010) found that the majority of participants in obesity treatment interventions in the UK were self-referred. This was also confirmed through discussions with staff from MEND who noted that over half of participants are self-referred, hearing about the programme from advertisements or word-of-mouth within their community. Participants are also

70 However, Dwyer et al (1983) measured the academic performance of students involved in a school based programme and found no detrimental effects

referred to treatment programmes from GPs and school nurses. However, Upton et al. (2010) found little success recruiting children by sending letters to parents as part of the National Child Measurement Programme.

Barriers to attendance

The main reason identified by Upton et al. (2010) for a lack of participation was due to the child not wanting to attend the programme. This was followed by other reasons such as other family commitments, problems with access to programme venues and parental attitudes. Upton et al. (2010) found that many parents believe that their overweight or obese child does not have a problem.

There may be a level of stigmatisation with some overweight or obesity treatment programmes due to societal influences where obese people may be perceived as lazy and unintelligent. For this reason, teachers may not wish to emphasise weight problems because they do not want to embarrass obese children (Bush et al. 1989), or they might not feel like a suitable role model because they are overweight themselves. Bush et al. (1989) argue that it is important to consider adult role models such as parents, teachers and community leaders because they are important for children's perceptions of education-based messages, community support and the long-term sustainability of programmes. Interventions that are inclusive and involve parents and the community are likely to be more effective.

Replicating interventions in London

There are a number of reasons why the treatment and prevention programmes that have experienced success internationally might not be effective in London. This is because the environment, cultures and people in London will be different from those who participated in the programme elsewhere. For example, many of the studies have been conducted in relatively homogenous groups in terms of ethnicity, income, social class and cultural beliefs. London has a very diverse population and it is much more difficult to develop a health related programme for a heterogeneous group with widely varying health beliefs related to diet and activity. It may be the case that programmes are successful because of the unique characteristics of the population, setting and culture rather than programme design that could be replicated in a different environment.

Limitations with the evidence

While the evidence reviewed has been able to provide some insight into what works to tackle childhood obesity in the most cost-effective manner, the evidence base (in terms of cost-benefit analysis and cost-effectiveness) is not particularly large. Indeed the relatively recent NICE guidance on obesity states, "For children and young people, it is accepted that the evidence base is far from complete"[71]. One of the main weakness of programme evaluations is a failure to consider the full costs and benefits. While cost per participant calculations were common, there was little consideration of both costs and benefits to determine the cost per positive outcome or a comparison of overall costs with overall benefits. In addition, for those programmes that have been evaluated, many are not randomised controlled trials and the sample sizes are typically small. There is a risk of bias in many of the results because the majority of participants are self-referred. This means that they are already more inclined to address their weight issues because they are actively seeking such a programme. Therefore, the intervention may not be as successful when implemented more broadly. There is also little evidence that includes long term follow up to see if the benefits of the intervention were sustained. One of the reasons for this is that participants tend to drop out after the conclusion

71 *Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children; December 2006; available at: http://www.nice.org.uk/nicemedia/live/11000/38159/38159.doc*

of the main programme and do no attend future measurement sessions (Upton et al. 2010). Therefore, it is recommended that in the future more robust evaluations are conducted with longer term follow-up to show what is effective in tackling child obesity.

Conclusions

Childhood obesity is a significant problem facing London. There are a number of programmes that have been implemented in the UK and internationally to address the rising trend of obesity, but few have been rigorously evaluated. This section has attempted to review the available evaluation evidence to provide some information on programmes that have proven to be cost-effective in improving child obesity outcomes. While it is clearly a complex area, it was found that community or school based programmes that are non-stigmatising can maintain child participation and achieve favourable outcomes. In addition, parents and carers have a very important influencing role in terms of diet and lifestyle and many of the best performing interventions involved both the child and parent. Early intervention is important for establishing healthy lifestyles and behaviours at an early age; and programmes that promote a healthy lifestyle were shown to be more effective than those focussed only on weight. Indeed, it was often argued that early prevention and intervention is more effective and less costly than treatment and other consequences of obesity later in life. Limiting television viewing and "screen time" was also effective in addressing sedentary lifestyles. When developing childhood obesity interventions it is important to consider this evidence of effectiveness as well as any unintended consequences that might occur as a result of the programme. Importantly, interventions should include evaluation to allow analysis of what is works well, and what is less effective.

4. An estimate of the costs of childhood obesity in London

This section attempts to estimate the costs of childhood obesity in London.

The section does not try to estimate the net present value of lifetime costs associated with childhood obesity. To do so requires a significant understanding of the longer term impacts of childhood obesity (such as the impact on educational attainment and increased risk of obesity in adulthood for example[72]) as well as forecasts of how the treatment costs may evolve over time; areas on which there appears to be little current robust knowledge[73]. Further, estimates of the private costs that may be incurred such as the additional expenditure on specialist/larger clothing or private health care costs such as private counselling are not included[74]. As such, the costs presented here reflect a lower bound estimation of the costs of childhood obesity to London's economy; they reflect only the direct public costs of treatment as well as the public costs of treating the consequences associated with obesity (such as cardio-vascular disease, diabetes and some cancers).

An estimate of the costs of adult obesity in London is also provided to illustrate the potential future costs of childhood obesity, should many of the currently obese children become obese adults.

Primary source for estimates

This section looks at three main papers and uses several methods to derive London and London children specific treatment costs of obesity. The range of estimates that these produce is indicative of a high degree of uncertainty in existing estimates of the costs of obesity. This is due to the methodology for estimating costs of obesity in England, on which the estimates in this note are based, being relatively simple and subject to a number of simplifying assumptions[75]. GLA Economics' best estimate lies at the lower end of this range where there is greater confidence in the underlying methodology and assumptions.

The papers used to derive the range of estimates are: (1) the House of Commons Health Select Committee (2004); (2) Foresight (2007); and, (3) Department of Health (2006).

The House of Commons (HoC) paper provides a broad estimate to the cost of obesity in England using the methodology employed by the National Audit Office (NAO) in 'Tackling Obesity in England'. The costs are built up from three areas: the direct costs of treating obesity, the direct cost of treating the consequences of obesity, and the indirect costs from loss of earnings due to sickness and premature mortality. Whilst the estimates from this paper are considered in this note, the HoC estimates are for costs incurred in 2002. Since then the prevalence of obesity has increased and so too have the costs. As such, the HoC estimates should be treated with caution[76].

72 Both lower educational attainment and increased risks of adult obesity would introduce an indirect cost element to the estimates. For example, whilst lower educational attainment directly affects the individual, for example due to lower wages, it also means that the economy will be operating below its potential

73 At least little robust quantitative evidence

74 Although these costs would not necessarily be a loss to London's economy as they may simply be a redistribution of income

75 For instance, the existing estimates do not account for the possible different cost of treating a disease depending on whether someone is obese or not. The papers will also assume that a certain proportion of strokes are due to obesity and apply this proportion to the total treatment costs for strokes to estimate the treatment costs of strokes due to obesity. However, this does not allow for, for example, the costs of treating a stroke being more costly for an obese patient (as compared to a non-obese patient) due to the higher operational risks and thus higher operational costs. In addition, limited readily available evidence on the indirect costs of obesity adds a further element of ambiguity to the estimates

76 This is also because the other papers which produce estimates of obesity used in this note use the HoC report as the basis for their estimates

The Foresight and Department of Health reports both provide estimates that are derived from the House of Commons report. Specifically, the Foresight report estimates how much obesity cost England in 2007 using the House of Commons cost estimates for 2002 as a base and scaling these up to reflect the increase in obesity prevalence between 2002 and 2007. The paper also estimates the potential future costs of obesity in England based on their modelled BMI changes in the population[77]. The Department of Health report develops a toolkit to provide estimates of the annual cost to NHS Primary Care Trusts of treating illnesses related to obesity (regardless of whether the illness was caused by obesity) based on a disaggregation of the national estimates calculated by Foresight. Clearly this latter method (using the DoH estimates) will skew the upper end of the estimates in this note.

It should be noted that the method employed by the House of Commons in estimating the direct costs involves the costs of treating the consequences of obesity. Many of these obesity linked diseases will not occur until later in life, most likely well into adulthood. As such, the estimates in this note are likely to overstate costs if they are taken solely to reflect the current treatment costs of childhood obesity.

The following paragraphs summarise the costs of childhood obesity. Full details of the method used and the calculations can be found in Annex 2 and Annex 3.

Childhood obesity in London, and England as a whole, is an increasing problem. It has been proposed that the Health and Public Services Committee conduct a review into childhood obesity in the capital. As part of this work GLA Economics was asked to estimate the costs to London of obesity amongst children. A full, detailed, primary assessment of the costs of obesity would be beyond the remit of this report and so the estimates presented here are derived from previous estimates of the costs of obesity at the national level.

The costs of obesity are generally divided into two distinct areas:
i) the direct costs of treating obesity and the consequences of obesity (such as diabetes); and,
ii) the indirect costs of obesity – principally through the loss of earnings due to sickness and premature mortality.

As children do not work, this report focuses primarily on the direct costs of childhood obesity to London.

Looking specifically at the direct costs, GLA Economics' best estimate of the current cost of publically funded treatment of childhood obesity and its associated consequences in London is £7.1 million a year. It should be noted that this is a rather simple estimate and reliant on a number of simplifying assumptions.

The total costs of childhood obesity to London in the long run will be much higher than this because many of the treatment costs and consequences of obesity (such as cardio-vascular disease, diabetes and some cancers) are not likely to be incurred until later in life (ie not in childhood). This is also true for the wider indirect costs such as lost productivity through sickness and premature death; they will be incurred in later life not in childhood.

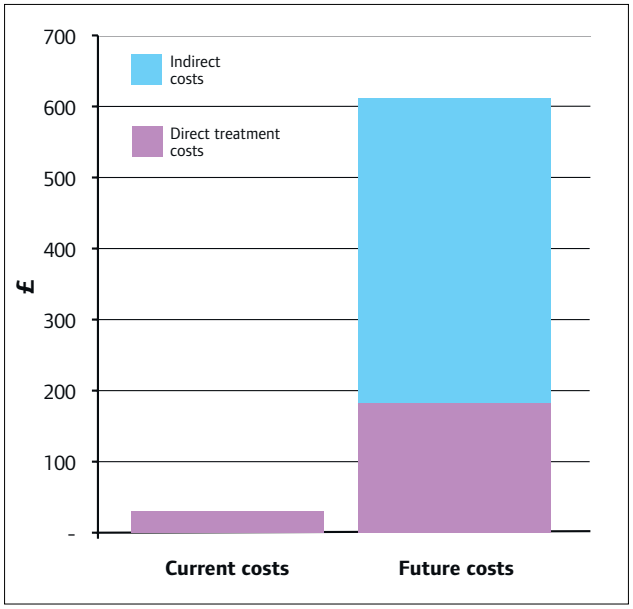
77 No inflation costs, either of prices or of healthcare, are incorporated in the costs presented in the Foresight paper

In London, the direct treatment costs of adult obesity – which could be considered as a proxy for the likely future costs of childhood obesity – are estimated to cost around £265.2 million a year in 2007. This represents roughly 2 per cent of total DoH identifiable expenditure on services in London in 2007/8. This is also equivalent to an estimated average treatment cost of around £184 per obese adult per year in 2007. As an upper limit, therefore, if we assume 79 per cent[78] of currently obese children in London become an obese adult, childhood obesity could represent a direct cost of around £33.3 million a year to London (assuming the direct treatment costs of obesity remain unchanged)[79].

Including the indirect costs of adult obesity (such as lost income from sickness and premature mortality), the total cost of adult obesity is estimated at around £883.6 million a year in 2007. This represents roughly 0.4 per cent of London's GVA in 2007[80] and an average cost of £611 per obese adult per year in 2007. Therefore, again as an upper limit, if we assume 79 per cent of currently obese children in London become an obese adult, childhood obesity could represent a total cost (direct and indirect) of £110.8 million a year to London's economy (assuming both indirect and direct costs remain unchanged).

In summary, an obese child in London is likely to cost around £31 a year in direct costs which could rise to a total (direct and indirect) cost of £611 a year if they continue to be obese in adulthood **(Figure 16).**

Figure 16: Breakdown of current and future annual costs per obese child in London



Note: The likely future costs have been proxied by the current costs of adult obesity in London. Not every obese child will grow up to be an obese adult so the future costs presented here can not be assumed to apply to every obese child in London.

It should be noted that this paper has considered several methods by which to calculate the costs of childhood obesity. This variety of methods is set out in the rest of this paper. The variety of methods produces a large range of estimates for the cost of childhood obesity. Given the current state of knowledge the estimates above represent GLA Economics' best estimate of the costs of childhood obesity, but the number of simplifying assumptions and nature of the underlying estimates used mean that these estimates should be used with caution.

78 *From HM Government report 'Healthy weight, healthy lives: a cross-government strategy for England' report which states that 55 per cent of obese 6-9 year olds and 79 per cent of obese 10-14 year olds remained obese into adulthood. As a result, as stated in the note, the use of the 79 per cent figure is likely to provide an upper limit to this estimate*

79 *Based on an estimated 1,445,090 obese adults and 229,383 obese children in London in 2007*

80 *Residence based smoothed GVA at current basic prices, ONS*

Annexes

Annex 1: Data sources used to calculate obesity cost estimates

Mid-year population statistics, ONS
- England population, 2007 (adult and child)
- London population, 2007 (adult and child)

Health Survey for England, 2007, The NHS Information Centre
- England adult obesity (including morbidly obese) prevalence rates, 2007
- England child obesity prevalence rates, 2007
- London adult obesity (including morbidly obese) prevalence rates, 2007
- London child obesity prevalence rates, 2007

For adults aged 16 and over, obese (including morbidly) is defined as having a BMI of 30kg/m2 or more.

Children are defined as aged 2-15 and obese if their BMI is greater than or equal to the 95th UK BMI percentile.

Hospital Episode Statistics (HES),The NHS Information Centre
- All finished admission episodes with a primary or secondary diagnosis of obesity, 2007/8
- Child finished admission episodes with a primary or secondary diagnosis of obesity

A finished admission episode is the first period of in-patient care under one consultant within one healthcare provider. Note that admissions do not represent the number of in-patients, as a person may have more than one admission within the year, The primary diagnosis is the first of up to 20 diagnosis fields in the HES data set and provides the main reason why the patient was admitted to hospital. As well as the primary diagnosis, there are up to 19 secondary diagnosis fields in HES that show other diagnoses relevant to the episode of care. These figures represent the number of episodes where the diagnosis was recorded in any of the 20 primary and secondary diagnosis fields in the record. Each episode is only counted once in each count, even if the diagnosis is recorded in more than one diagnosis field of the record. Figures have not been adjusted for shortfalls in data. Counts include people resident in English Strategic Health Authorities only, including admissions where the SHA of residence was England but not further specified and excludes admissions where the SHA of residence was unknown. Total includes numbers where gender was unknown.

HES data should be treated with some caution. Selecting cases in which obesity is coded (recorded formally in the patient notes and invoiced for) as part of the diagnosis / procedure can cause misreporting of actual obesity levels due to the way in which ICD-10 (diagnosis codes) and OPCS codes (procedure codes for treatments) are generally used within hospitals. The ICD-10 codes referring to obesity are used in situations where the diagnosis is for the obesity only, they are not generally used where a patient is not being treated for the obesity. As a result an obese patient would not normally have a diagnosis of obesity recorded if they attend following, for example, a car crash since the obesity is not part of that consultation, even if treatment costs are higher due to the patient's obesity (although the clinician could choose to record it if desired). Even if the obesity is noted informally by the doctor it would have to be relevant to the condition being treated for it to be regularly coded into the patient record.

The situation is further complicated by inconsistencies between different Trusts in how/where/when obesity is recorded, some Trusts will recommend that obesity is recorded as part of the diagnosis (bearing in mind there is no guarantee that this will always be followed by the clinicians), others may instead leave out the diagnosis and note any complications caused by the obesity within the treatment coding. This would mean that the obese patient, for example, suffering a stroke does not receive a diagnosis of obesity but will instead have a diagnosis of stroke and a treatment code which indicates 'complications' when treating them. The above cases will not be counted when trying to estimate obesity using HES data.

Prescribing Analyses and Costs (PACT), Prescription Pricing Division of the Business Services Authority (PPD of the BSA), The NHS Information Centre

- Total net ingredient cost of drugs for the treatment of obesity prescribed by Primary Care and dispensed in the community in England, 2007
- Net ingredient cost per item of drug for the treatment of obesity prescribed by Primary Care and dispensed in the community in England, 2007
- Prescription items in London for the treatment of obesity prescribed by Primary Care and dispensed in the community, 2007

This information was obtained from the Prescribing Analysis and Cost Tool (PACT) system, which covers prescriptions prescribed by GPs, nurses, pharmacists and others in England and dispensed in the community in the UK. Prescriptions written in hospitals /clinics that are dispensed in the community, prescriptions dispensed in hospitals, dental prescribing and private prescriptions are not included in PACT data.

Net Ingredient Cost (NIC) is the basic cost of a drug. It does not take account of discounts, dispensing costs, fees or prescription charge income.

Prescriptions are written on a prescription form known as a FP10. Each single item written on the form is counted as a prescription item.

Public Expenditure Statistical Analyses, HM Treasury

- Department of Health identifiable expenditure on services in London, 2007/8 outturn.

Annex 2: Detail of method for deriving estimates

The range of estimates for the costs of treating childhood obesity in London in this note are derived from the findings in three papers. The first two (House of Commons (2004) and Foresight 2007)) provide annual cost estimates of obesity for England as a whole. To convert these estimates to children in London a two-stage approach has been used. First the national costs have been apportioned to the London level. Second the London wide costs are apportioned to children in London (where children are aged 2-15 years).

Two alternative assumptions for each conversion stage are used which results in a range of estimates.

The Department of Health paper provides obesity related treatment cost estimates for London PCTs so there is only one stage of conversion to apportion these costs to children in London. As with the other estimates, there are two alternative assumptions for this apportionment.

For the move from England to the London level the two variables used are:

a) London's share of all "finished admission episodes with a primary or secondary diagnosis of obesity"[81] (12 per cent) (and for the House of Commons estimate only approximate London share of total cost of prescription items for the treatment of obesity in England (13 per cent)); and,
b) London's share of the obese population of England (15 per cent).

For the move from the London level estimate to London's children the two variables used are:

c) the share of London child 'obesity admissions' in all London admissions (3 per cent); and,
d) the share of London's obese population that is children (14 per cent).

It is worth noting that whilst the method used to move from England figures to London figures are of broadly the same magnitude there is a relatively large difference between the share of child obesity admissions and the share of children in London's obese population. In the absence of other information this would seem to suggest that children are disproportionately less likely to receive treatment relating to their obesity when compared to the adult population. This is perhaps not surprising given that many of the consequences associated with obesity and requiring treatment (such as stroke and gallstones) are more likely to occur later in life. Although this paper considers costs using the two varying methods the preferred estimates are based on shares of finished admission episodes (a and c)[82].

Detail of the estimates:

Estimate 1: *Using the House of Commons (2004) report*

The House of Commons paper provides a broad estimate to the cost of obesity in England using the methodology employed by the NAO in 'Tackling Obesity in England'. The costs are estimated for the year 2002. They are built up from three areas: the direct costs of treating obesity, the direct cost of treating the consequences of obesity (such as diabetes and gallstones), and the indirect costs from loss of earnings due to sickness and premature mortality. England wide obesity costs per annum are estimated for this paper as follows:

81 In the rest of the document the term, "finished admission episodes with a primary or secondary diagnosis of obesity" will be replaced by the phrase, "obesity admissions'

82 The main reason for this being that the admissions data account for the fact that children are less likely, than adults, to receive treatment for their obesity. In contrast using the share of obese children in the total population would implicitly assume that children and adults had an equal probability of receiving treatment for their obesity

		Costs in 2002 (£ millions)
Total cost of treating obesity	GP consultations, ordinary admissions, day cases, outpatient attendances	32.5 – 35.7
	Prescriptions	13.3
Total cost of treating the consequences of obesity	GP consultations, ordinary admissions, day cases, outpatient attendances	370 - 460
	Prescriptions	575 - 625
Total indirect costs		2,350 – 2,600
	Total cost of obesity	**3340.8 - 3734**

Whilst estimates of the treatment costs and potential longer term costs of obesity amongst children for London using the House of Commons report are estimated here, they should be treated with caution. This is because the costs are for 2002 and the prevalence of obesity amongst children has increased since then as have the total treatment costs. These estimates would therefore impose a bias on the lower end of our estimates. Nevertheless, it was deemed important to look at this report as the later two papers from which the estimates in this note are derived rely on it.

Using these estimates in the House of Commons report and applying the assumptions stated earlier in this paper:

- Applying assumptions a, and c the cost of childhood obesity in London is estimated to lie between £3.24 million and £3.69 million a year
- Applying assumptions b and d the cost of childhood obesity in London is estimated to lie between £20.04 million and £22.94 million a year

Combining these two gives us a range to the cost of childhood obesity in London of between £3.24 million and £22.94 million for 2002.

To estimate how much childhood obesity in London could cost in the future both the direct and indirect costs of adult obesity in London have been considered. Specifically, for total direct treatment costs of obesity and its consequences the London childhood obesity cost estimate is subtracted from the total obesity treatment costs for London. For indirect costs the finding in the House of Commons report that indirect costs of obesity are around two times as large as the direct treatment costs is applied[83]. The indirect costs calculated in the report covers both the loss of earnings due to obesity attributable sickness (via days of work) and loss of earnings due to early mortality. However, it does not include productivity losses from lower educational attainment that is associated with childhood obesity. Further, it does not make allowance for government savings that can result from early mortality such as pension payment savings and savings from health care costs associated with ageing.

As a result, obesity amongst adults in London is estimated to cost between £399.4 million and £528.4 million in 2002.

83 Specifically we multiply the total national direct treatment costs attributable to London by the average ratio of the upper and lower estimates of direct to indirect costs (roughly 2.33)

Estimate 2: *Using the Foresight report*
This report uses the House of Commons finding as a base and projects to 2007 how these costs may have changed based on the changed prevalence of obesity. They do not include inflation costs, either of prices generally or of healthcare costs. England wide NHS obesity costs per annum found in this paper are:

	2007	2015	2025	2050
NHS costs attributable to obesity (£ million/year)	2,300	3,900	5,300	7,100

Using these estimates in the Foresight report:

- Applying assumptions a and c, the cost of childhood obesity in London is estimated to be around £7.08 million in 2007/8
- Applying assumptions b and d, the cost of childhood obesity in London is estimated to be around £46.52 million in 2007/8

Combining these two gives a range to the treatment cost of childhood obesity in London of between £7.08 million and £46.52 million in 2007/8. This represents around 0.05 per cent to 0.34 per cent of total identifiable health expenditure on services in London in 2007/8.

The Foresight report also project costs of treating obesity nationally based on a microsimulation prevalence projection. Assuming no other change in assumptions (eg retaining the 2007 ratios used to convert national total population to regional child obesity cost estimates), the costs of childhood obesity to London could increase to between:

- £12.00 million to £78.89 million a year by 2015,
- £16.31 million to £107.21 million a year by 2025, and
- £21.85 million to £143.62 million a year by 2050.

Again, to estimate how much childhood obesity in London may cost in the future both the direct and indirect costs of adult obesity in London are considered. The same method as in estimate 1 is applied; for total direct treatment costs of obesity and its consequences, the London childhood obesity cost estimates is subtracted from the total obesity treatment costs allocated to London. For indirect costs the finding in the House of Commons report that indirect costs of obesity are around two times as large as the direct treatment costs is used. *As a result, obesity amongst adults in London is estimated to cost the economy between £883.6 million and £976.7 million in 2007*. Further, the cost of obesity amongst adult in London is estimated to rise to between:

- £1,498 million to £1,656 million a year by 2015
- £2,036 million to £ 2,251 million a year by 2025
- £2,728 million to £3,015 million a year by 2050.

Estimate 3: *Using the Department of Health (DoH) report*
This paper provides estimates of the annual costs to NHS PCTs based on a disaggregation of the national estimates calculated by Foresight. For England and London PCTs this paper estimates the annual costs to the NHS of obesity are:

Estimated annual costs to NHS of obesity related illnesses (£ millions)	2007	2010	2015
England	7,207	7,805	8,962
London	1,144	1,238	1,422

The Department for Health estimates allocate around 16 per cent of the national obesity costs to London. In contrast, our own assumptions (a)i and (a)ii allocate around 12 per cent and 15 per cent respectively.

It should be noted that the DoH national treatment cost of £7,207 million is significantly higher than the Foresight estimate used above of £2,300 million. This is because the DoH estimates are based on results within the Foresight's report on the cost of treating all diseases related to obesity regardless of the cause[84].

Using the Department of Health report findings:

- Applying assumption c, the cost of childhood obesity in London is estimated to be around £29.73 million in 2007/8
- Applying assumption d, the cost of childhood obesity in London is estimated to be around £156.65 million in 2007/8

Combining these two gives a range to the estimated cost of childhood obesity in London of between £29.73 million and £156.65 million in 2007/8. This represents around 0.22 per cent to 1.14 per cent of total identifiable health expenditure on services in London in 2007/8.

As above, holding constant the numbers in our assumptions, the future costs presented in this report suggest that the cost of childhood obesity in London could rise to between £32.2 million and £169.6 million a year in 2010 and £36.97 million and £194.76 million a year in 2015.

Again, the future cost of childhood obesity in London is estimated by looking at both the direct and indirect costs of adult obesity in London. Applying the same method as previously *obesity amongst adults in London is estimated to cost between £3,288 million and £3,711 million in 2007*. Further, the cost of obesity amongst adults in London is estimated to rise to between:

- £3,560 million to £4,018 million a year by 2010
- £4,089 million to £4,614 million a year by 2015.

84 The DoH estimates are also based on numbers from an updated Health Survey for England

Annex 3: Detailed obesity assumption calculations

			England	London
1	Adult population (16+)	All (2+3)	41,438,000	6,143,000
2		Male	20,168,000	3,022,000
3		Female	21,270,000	3,121,000
4	Child population (2-15)	All (5+6)	8,427,900	1,236,800
5		Boys	4,315,400	629,900
6		Girls	4,112,500	606,900
7	Adult obesity (%)	All	24	
8		Male	24	22
9		Female	24	25
10	Child obesity (%)	Boys	17	21
11		Girls	16	16
12	Adult obesity	All (13+14)	9,948,429	1,445,090
13		Male (2*8)	4,840,320	664,840
14		Female (3*9)	5,104,800	780,250
15	Child obesity	All (16+17)	1,391,618	229,383
16		Boys (4*10)	733,618	132,279
17		Girls (5*11)	658,000	97,104
18	All finished admission episodes with a primary or secondary diagnosis of obesity		80,914	9,578
19	Child finished admission episodes with a primary or secondary diagnosis of obesity		2,104	
20	Total net ingredient cost of drugs for the treatment of obesity prescribed by Primary Care and dispensed in the community		51,580,000	
21	Net ingredient cost per item of drug for the treatment of obesity prescribed by Primary Care and dispensed in the community	Total	42	
22		Orlistat	39	
23		Sibutramine	45	
24		Rimonabant	58	
25	Prescription items for the treatment of obesity prescribed by Primary Care and dispensed in the community	Total	1,233,000	159,000
26		Orlistat	827,000	105,000
27		Sibutramine	294,000	35,000
28		Rimonabant	112,000	18,000

Assumption a: London's share of all finished admission episodes with a primary or secondary diagnosis of obesity in England, and for the House of Commons estimate only approximate London share of total cost of prescription items for the treatment of obesity in England: 11.8 per cent and 13 per cent respectively

This assumption implicitly assumes that the average cost of a finished admission episode is the same in London and England (and that the prescription costs to treat obesity and its consequences are proportionately the same in London as it is in England).

Assumption b: London's share of total England obesity (all ages 2+): 14.8 per cent

This assumption assumed that there is no difference in the degree of obesity, and thus the costs of treating an obese person, in London and England.

Assumption c: Proportion all finished admission episodes with a primary or secondary diagnosis of obesity who are aged 2-15: 2.6 per cent

This assumption assumes that, where a finished admissions episode occurs, the costs incurred are the same whether the patient was an adult or child.

Assumption d: Proportion of total London obesity that is childhood obesity: 13.7 per cent

Again, this assumption assumes that there is no difference in the costs of treating an obese adult or child.

Annex 4: Supplementary estimate of childhood obesity costs in London

As part of this work we came across a study which models total child (aged 4-17) medical expenditures (prescription drugs, in-patient and office based expenditures) in the US[85] to calculate an obesity[86] attribution factor (OAF). The E. Johnson et al. (2006) paper controls for other factors that may cause health expenditures to differ across children. Specifically, the model used controls for age, mother's age, gender, region, residence in an urban area, race, income, underweight, insurance status and disability.

One of the main advantages of this study over the three studies used in the main body of this paper is that the estimates allow for obesity to cause the treatment costs to be different (most likely higher) for any medical condition. Further, this study makes no assumptions about the illnesses associates with obesity.

The study finds an OAF of 0.5 per cent. This implies that 0.5 per cent of total medical expenditure for children is attributable specifically to obesity.

Unfortunately, we have been unable to attain an estimate of the total treatment costs for children in London which would have provided us with a monetary value. We have thus not been able to make wider use of the findings in this paper.

85 Obtained from the 1998 US Medical Expenditure Panel Survey

86 Where obesity is defined as the BMI-for-age-and-gender greater than or equal to the 95th percentile

Annex 5: Estimating the costs of overweight children in London

In addition to estimating the costs of childhood obesity in London we have also looked at the cost that overweight children impose. The data here, however, is more limited. As such, we estimate only the treatment costs of overweight children in London. We were not able to approximate the long term costs of overweight children by the current cost of overweight adults to London's economy because we could not estimate the indirect costs. In this section we look at overweight children excluding obese children.

As with the main body of this paper our estimates are based on three reports: (1) the House of Commons Health Select Committee (2004), (2) Foresight (2007), and (3) Department of Health.

The House of Commons and Foresight studies provide estimates of the treatment costs of an elevated BMI (overweight and obese) for England as a whole. To these we apply a three stage conversion: we first split out the obesity treatment costs from the elevated BMI costs, we then apportion the costs to London, and then apportion these London wide costs to London children (aged 2-15 years).

The Department of Health report provides estimates of the treatment costs of diseases related to an elevated BMI to London PCTs. Here we apply a two stage conversion; we first separate out the treatment costs of diseases related to obesity, and then apportion the remaining costs to children in London.

As with our estimates of the treatment costs of child obesity in London, the estimates here are likely to overstate costs if they are taken to solely reflect the current treatment costs of overweight children. Again, this is because the papers include costs involved in treating the consequences of being overweight (such as diabetes), and many of these will not occur until later in the child's life.

The assumptions used in calculating our estimates here are constructed as follows (using 2007/8 data):

a) Apportioning costs to London: The share of total England costs of treating overweight and its consequences in London is equal to the share of overweight people in England that are in London. (Health Survey for England, 2007, The NHS Information Centre)
b) Apportioning costs to children: The share of London wide costs of treating overweight attributable to children is equal to the share of London's overweight population that are children. (Health Survey for England, 2007, The NHS Information Centre)[87]

Annex 5 provides further information and the numbers to these assumptions.

Estimate 1: Using the House of Commons (2004) report:

This report makes the crude assumption that the costs of overweight are half those of obesity and that the prevalence of overweight is twice that of obesity. Applying this to the estimated direct costs of treating obesity and the consequences of obesity (such as diabetes and gallstones) in England

87 *It should be noted that the use of this variable is likely to overestimate the costs of treating overweight children. This is because, as shown earlier, evidence from obesity admissions data would suggest that children are much less likely to need treatment for obesity issues when compared to adults (ie the share of child obesity admissions in total obesity admissions is much less than the share of obese children in the obese population)*

provides an estimated treatment cost of £990.8 million to £1,134 million a year in 2002. This would imply, using assumptions (a) and (b) above that the cost of overweight children in London was around £10 million to £11 million in 2002.

Estimate 2: Using the Foresight (2007) report

This paper estimates the following NHS costs in England of overweight people:

	2007	2015	2025	2050
NHS cost of elevated BMI minus NHS cost of obesity alone (£ million/year)	1,900	2,500	3,000	2,600

Using these estimates and assumptions (a) and (b) we estimate that the treatment cost of overweight children in London was £19.2 million in 2007.

If we leave the numbers in our assumptions unchanged (i.e. retaining the 2007 ratios used to convert national total to regional child overweight treatment costs), then the treatment costs of overweight children could increase to:

- £25.3 million a year by 2015
- £30.3 million a year by 2025, and
- £26.3 million a year by 2050.

Estimate 3: Using the Department of Health (2008) report

Focussing on the cost of treating elevated BMI related illnesses (regardless of cause), this paper calculates the following for London PCTs:

Estimates annual costs to NHS of diseases related to obesity minus estimated annual costs to NHS of diseases related to overweight and obesity (£million)	2007	2010	2015
England	6,684	6,611	6,453
London	1,060	1,049	1,024

Using these estimates and assumptions (a) and (b) we estimate that the treatment cost of diseases related to overweight children in London was £79.6 million in 2007.

If we leave the numbers in our assumptions unchanged (i.e. retaining the 2007 ratios used to convert national total to regional child overweight treatment costs), then the treatment costs of overweight children could fall to:

- £78.8 million a year by 2010, and
- £76.9 million a year by 2015.

Together these estimates suggest that the treatment cost of overweight children in London was between £19 million and £80 million in 2007. This represents 0.1 per cent to 0.6 per cent of total identifiable health services expenditure in London in 2007. We have not included in this range our estimates derived using the House of Commons report. This is because these relate to treatment costs 2002 and given that the prevalence of overweight children has risen since then it is likely that the treatment costs have also increased.

Annex 6: Detailed overweight assumption calculations

			England	London
1	Adult population (16+)	All (2+3)	41,438,000	6,143,000
2		Male	20,168,000	3,022,000
3		Female	21,270,000	3,121,000
4	Child population (2-15)	All (5+6)	8,427,900	1,236,800
5		Boys	4,315,400	629,900
6		Girls	4,112,500	606,900
7	Adult overweight (excluding obesity) (%)	All	37	
8		Male	41	37
9		Female	32	30
10	Child overweight (excluding obesity) (%)	Boys	14	13
11		Girls	14	14
12	Adult overweight (excluding obesity)	All (13+14)	15,322,060	2,054,440
13		Male (2*8)	8,268,880	1,118,140
14		Female (3*9)	6,806,400	936,300
15	Child overweight (excluding obesity)	All (16+17)	1,179,906	166,853
16		Boys (4*10)	604,156	81,887
17		Girls (5*11)	575,750	84,966

Assumption (a): London's share of England's overweight population: 13.5 per cent

Assumption (b): Children's share of London's overweight population: 7.5 per cent

Annex 7: Evaluated programmes

Programme	Country	Programme Description	Methodology	Result
MEND (Mind, Exercise, Nutrition, Do it!)	UK	MEND's group-based afterschool courses are available in over 300 locations across the UK, delivered by one or more local delivery partners. In each locality, local health, education and fitness professionals are trained by MEND to deliver clinically-effective behaviour-change programmes. Children attend the courses with their parents. The course is made available free-of-charge.	Randomised Controlled Trial was conducted and used to inform a cost-effectiveness study. Assumes that deadweight is 0% and attribution is 100%	Cost-effectiveness analysis: £1,671.5 per QALY Below NICE threshold of £20,000 to £30,000 per QALY
LEAP	UK	LEAP (Local Exercise Action Pilots) programmes were commissioned in 2004, and ran until 2006, to test the best ways of encouraging people to be more active. The pilots focus on those who do little exercise and those at risk from health problems. The LEAP pilots involved a wide range of activities reaching various target groups, from activity camps for children to community walking programmes for elderly people recovering from strokes.31 The methods included targeted exercise 'referrals' from NHS professionals, peer mentoring sessions, exercise classes and outdoor activities, health campaigns and directories, interviews by trained advisers, and training & support for community leaders and coordinators One LEAP site was located in each of the nine English regions, with the exception of the South West region which had two pilots	Cost effectiveness analysis (although outcome is in terms of increased physical activity rather than reduced BMI) Outcomes A total of 10,433 participants were recorded as attending LEAP interventions. 80% of LEAP participants were sedentary at the start of the project. A comparison of 1051 participants showed an average increase in physical activity equivalent to around 75 minutes of additional brisk walking per week. Nearly two-thirds (63%) of those who were lightly active undertook more physical activity.	Cost: £2.6million Cost per participant: £50 to £3,400 Cost per participant who improved their physical activity: £260-£2,790 Cost per QALY gained: £50-£510 (Compared to NICE funding threshold of £30,000 per QALY gained) Savings to NHS per participant: £770 - £4,900
Counterweight	UK	Counterweight promotes behavioural strategies which seek to change eating habits, activity levels, sedentary behaviours and thinking processes that contribute to a person being overweight or obese. Counterweight specialists are registered dieticians/nutritionists. The programme provides an active weight loss phase for 3 to 6 months followed by long term weight loss maintenance. Therefore patients are learning the best way to lose weight and keep it off, which is an important part of any weight loss programme. The programme is currently only provided to people aged 18-75	Cost effectiveness evaluation has been undertaken Mean weight changes in Counterweight attenders was –3 kg and –2.3 kg at 12 and 24 months. Counterweight delivery cost was £59.83 per patient entered.	Quality-adjusted Life-Year cost was £2017 where background weight gain was limited to 0.5 kg/year, and £2651 at 0.3 kg/year

Programme	Country	Programme Description	Methodology	Result
WATCH IT	UK (Leeds)	Community based programme for selected children aged 8-16 and their families. Community trainers facilitate the programmes, but are supported by health professionals (such as dieticians, psychologists, sports physiologists and a paediatrician). The programme consists of three components: Frequent individual appointments (30 mins, initially weekly) for the child and parent to provide encouragement, support and motivational counselling); Group activity sessions (1 hour, weekly) at a local sports centre; and Group parenting sessions (once individual sessions have reduced in frequency)	Follow up BMI data was available on 68 children at 3 months, and 48 children at 6 months. Fifty four per cent of children at 3 months and 71% at 6 months had shown a decrease in BMI SDS scores. Reasons given for not continuing to participate in the programme included transportation difficulties, clash with mosque times, and family illness	Not yet assessed in terms of cost effectiveness, but early indications of success in terms of BMI scores and community facilitation suggest that it is potentially cost effective. Currently an RCT is being developed and undertaken which should provide more robust and detailed results.
Carnegie Camps	UK	Carnegie Weight Management provides residential camps, day camps and Carnegie clubs to assist children of different degrees of overweight and obesity. The Carnegie International Camp has been evaluated. It consists of an eight week summer camp for obese children aged 11-17, providing an environment that aims to support and engage the children. They receive individual attention and experience a range of different activities to improve their confidence and skills in order to achieve weight loss and weight management.	Significant improvements across a range of physiological and psychological outcomes such as BMI, waist circumference, and self esteem	Has not been assessed in terms of cost-effectiveness but the programme is expensive due to the camp nature of the programme and the high ratio of staff to participants.
National Child Measurement Programme	UK	Primary Care Trusts collect height and weight data for all pupils in reception (4-5 years) and year 6 (10-11 years). Nottingham City piloted a proactive follow-up of obese or overweight children in two schools with high prevalence of obesity. Follow up consisted of a school nurse telephoning families to explain results, assess willingness to change and offer a 30 minute clinic appointment to discuss individual issues and offer advice. Further appointed or follow up may be offered.	Anecdotal evidence only but it does provide data on prevalence of obesity	Parents reported that they had benefited from the program and staff regarded the experience positively

Programme	Country	Programme Description	Methodology	Result
Change 4 Life	UK	Social marketing movement aimed at helping everyone eat well, move more and live longer	No evaluation evidence available as yet	More than 400,000 families have joined and 200,000 families who are likely to be at risk of childhood obesity are being supported through personalised mailouts and materials
Planet Health	United States	School based intervention designed to reduce obesity in youth of middle-school aged children. It is an inter-disciplinary curriculum for teaching middle school students about nutrition and physical activity, such as: • Learning about nutrition and physical activity while building skills in language, arts, math, science and social studies • Understanding how health behaviours are interrelated • Choosing healthy foods, increasing physical activity, and limiting TV and other screen time. 10 middle schools in Boston, Massachusetts were randomly assigned to either intervention (5 schools) or control condition (5 schools)	Cost-effectiveness analysis. Costs: intervention costs; medical care costs associated with adult overweight; costs of productivity losses associated with adult overweight. Health outcome measured as cases of adult overweight prevented and quality-adjusted life years (QALYs) saved A randomised, controlled trial was conducted to evaluate the efficacy of the program.	Intervention costs US$33,677 or $14 per student per year Program would prevent an estimated 1.9% of the female students becoming overweight adults, saving 4.1 QALYs. Savings: $15,887 in medical care costs and $25,104 in loss of productivity costs Cost of $4,305 per QALY saved and a net saving of $7313 to society.
CATCH	US	School based health program for children up to year eight. The programme seeks to make changes to the school environment related to food consumption, physical activity and tobacco use. It is a coordinated approach - "in the Classroom, in the Cafeteria, in Physical Education, at Home, and After School".	Cost effectiveness	$900 per QALY
Hip-Hop to Health Jnr	US	A combined pre-school and home intervention in African-American and Latino communities. Physical activity and nutrition education were aimed at under fives in preschool. The home component involved health related education and homework for the parents. A small financial reward ($5) was given on completion of the program	Randomised Controlled Trial but no assessment of cost-effectiveness	Significantly slower rate of BMI increase for African-American participants than the control group but no significant difference for Latino groups.

Programme	Country	Programme Description	Methodology	Result
The APPLE Project	New Zealand	Two-year community based obesity prevention initiative, based in Otago New Zealand. All children enrolled in the seven primary schools servicing the intervention (n=4) and control (n=3) were invited to participate. The intervention involved the provision of community activity coordinators at each intervention school who encouraged children to be a little more physically active every day by increasing the variety and opportunities for physical activity at interval, lunchtime and after school beyond what was currently provided. Nutrition based interventions involved providing the schools with a cooled water filter and the provision of free fruit for a 6 month period. Nutrition resources were also developed to reduce the consumption of sugary drinks and increasing fruit and vegetable intake.	Cost of intervention per child. Could not calculate difference in health-related quality of life. Project was implemented in 4 schools with a total of 279 children.	Significant reduction in BMI scores but difference in health related quality of life was not observed in this study. Total cost: NZ$357,490 Present value of costs over 2 years: NZ$332,952 NZ$1,193 per child for 2 years
The expanded food and nutrition education program (EFNEP)	US	It is designed to assist low income individuals in acquiring the knowledge, skills, attitudes, and changed behavior necessary for nutritionally sound diets, and to contribute to their personal development and the improvement of the total family diet and nutritional well-being. The program is available in various forms for both adults and children.	Cost effectiveness analysis and cost benefit analysis	$20 863 per QALY CBR: 0.82
Switch what you Do, View and Chew	US	The evaluation examined the immediate and short-term, sustained effects of the Switch program, which targeted decreasing children's screen time, increasing fruit and vegetable consumption, and increasing physical activity in the family, school, and community.	Participants were 1,323 children and their parents from 10 schools in two states. Schools were matched and randomly assigned to treatment and control. Measures of the key behaviours and body mass index were collected at baseline, immediately post-intervention, and 6 months post-intervention	No cost effectiveness analysis has been undertaken. Program showed small to moderate improvement in screen time and fruit and vegetable consumption for participants

Programme	Country	Programme Description	Methodology	Result
Nurse Family Partnership for low income women	USA and piloted in UK	The programme is designed to improve the health, well-being and self-sufficiency of young, first time parents and their children. It is a voluntary home-visitation service that starts in early pregnancy and continues until the child is 24 months old. It is a targeted service, specifically for young mothers with their first child. The nurses can provide nutrition advice, such as the encouragement of breastfeeding.	UK BCR calculated using cost benefit analysis conducted by Aos at WSIPP in US, which was adjusted with UK monetary values of benefits The benefits are not considered in terms of a reduction in obesity	BCR: 1.65 NPV: £11,818 per participant
Home visiting programmes for at-risk mothers and children	USA	Focus on mothers considered at risk for parenting problems, based on factors such as maternal age, marital status and education, low household income, lack of social support or in some programs mothers testing positive for drugs at the child's birth.	UK BCR calculated using cost benefit analysis conducted by Aos at WSIPP in US, which was adjusted with UK monetary values of benefits The benefits are not considered in terms of a reduction in obesity	BCR: 8.91 NPV: £24,756
Healthy families America	USA	A network of programs that grew out of the Hawaii Healthy Start program. At-risk mothers are identified and enrolled either during pregnancy or shortly after the birth of a child. The intervention involves home visits by trained paraprofessionals who provide information on parenting and child development, parenting classes and case management	UK BCR calculated using cost benefit analysis conducted by Aos at WSIPP in US, which was adjusted with UK monetary values of benefits The benefits are not considered in terms of a reduction in obesity	BCR: 2.66 NPV: £4,332 per child
Walking School Bus From ACE study	Australia	This is an active transport program for primary school children in Victoria, Australia. It aims to increase the number of primary school children walking to school. Children are accompanied by two adult 'conductors' (at a ratio of 1 adult to 8 children) and travel along a set route through a neighbourhood picking up children along the way at designated stops and delivering them to school. The volunteer conductors complete an induction program, are given police checks, and are covered by a Council's volunteer insurance policy.	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved Assumes reduction in BMI due to intervention would be maintained over the life of the child; assumes that 50% of all enrolled participants are new to active transport to school	Cost per DALY saved $0.77m Not considered to be cost effective under current assumptions

Programme	Country	Programme Description	Methodology	Result
TravelSMART schools From ACE study	Australia	A program specifically targeted at children in years 5 & 6 which has been piloted in six schools in Victoria. It is designed to engaged the whole school community through information sessions, professional development program for teachers, classroom activities, school activities and events and promotion of the program within the local community	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $260,000 Net cost per DALY saved with attribution of costs to obesity prevention only: $250,000 Net cost per DALY saved with attribution of costs to all objectives: $70,000 Not cost effective
Active After School Community Programme From ACE study	Australia	Schools and approved out-of-school hours care services are invited to be involved in the programme which offers an additional hour of physical activity two or three days per week for four 8-week terms	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $90,000 Not cost effective under current assumptions
Orlistat therapy in Australian adolescents From ACE study	Australia	The intervention consists of treatment with orlistat 120mg, given three times daily orally in conjunction with dietary, exercise and behavioural modifications. It is delivered over a period of 12 months for adolescents aged between 12 to 16 years with a BMI of 2 units additional to the BMI units corresponding to the 95th percentile of the age and gender specific BMI distribution	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $14,000 Net cost per DALY saved: $8,000 Cost effective
Family based GP-mediated intervention targeting overweight and moderately obese children From ACE study	Australia	Modelled on the LEAP (live, eat and play) study, a randomised controlled trial conducted by the Centre for Community Child Health (CCCH) at the Royal Children's Hospital in Victoria in 2002-03. Delivery of three 2.5 hour training sessions for participating GPs who then provide four individual consultations per patient and parents, then three shorter visits over a 12 week period	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $32,000 Net cost per DALY saved: $24,000 Cost effective
Multi-faceted school-based intervention without active physical education From ACE study	Australia	The Tamir intervention is based on the KYB (Know your body) program but adapted for grade 1 Israeli children and did not include an active physical activity program. The regular teacher delivers the intervention over a two year period and this consisted of 15-20 hours of teaching on health and nutrition, and physical activity per academic year for two years	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $14,000 Net cost per DALY saved: $6,000 Cost effective

Programme	Country	Programme Description	Methodology	Result
Laparoscopic adjustable gastric banding for severely obese adolescents From ACE study	Australia	Laparoscopic adjustable gastric banding surgery for adolescents aged 14-19 years with BMI >35. The intervention involves recruitment, pre-surgery consultations and investigations, surgery, and post surgery follow up. Currently it is largely only available through private health insurance, so the intervention has been modelled on this basis.	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $10,000 Net cost per DALY saved: $4,000 Net cost per DALY saved excluding parent time cost: $2,000 Cost effective
School based health promotion program to reduce TV viewing From ACE study	US	School based health promotion program to reduce TV viewing based on Bandura's social cognitive theory and trialled in grade 3 and 4 children in a randomised controlled trial. Regular classroom teachers deliver the intervention over 6 months- activities include television turnoff challenge, TV budget, intelligent TV viewing with educational newsletters for parents with strategies for limiting TV	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $3,000 Cost effective and potentially cost saving.
Multi-faceted school-based intervention with additional active physical exercise From ACE study	Greece	Based on US 'Know your body' program, and incorporates an active physical exercise component in addition to the education components. The intervention was trialled on grade 1 children in a controlled (but not randomised) intervention trial in Greece. Regular classroom teachers delivered the intervention over a three year period. Education included nutrition, health, physical fitness and parental involvement. Physical exercise consisted of two 45 min practical exercise classes per week per academic year	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $7,000 Cost effective and potentially cost saving
School-based focused nutrition education intervention to reduce the consumption of sweetened carbonated beverages From ACE study	UK	The program is targeted at children aged 7 to 11 years, consisting of four one-hour educational sessions over the course of the school year (one session per school term) delivered by the study investigator with the assistance of the regular teachers. It was trialled in a randomised controlled trial.	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved AU$3,000 Cost-effective and potentially cost saving

Programme	Country	Programme Description	Methodology	Result
Family based targeted program for obese children From ACE study	Sweden	Eligible overweight or moderately obese children are selected from GPs existing patients. Medical examination is provided, along with dietary counselling by a paediatrician and a dietician. Six family therapy sessions are conducted by a paediatrician and psychologist over a 14-18 month period. There are additional medical checks throughout the course of the program	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved $4,000 Cost-effective and potentially cost saving
Multi-faceted school-based intervention targeted at overweight or obese children From ACE study	Australia	A peer-led program of counselling and social support for overweight or obese children in grades 2 to 5. It is run over 12 weeks, with responsible and well-liked older students (eighth-grade) weigh children, check lunch boxes for nutritious foods and recommend changes to eating and exercise habits. Children are rewarded with stickers and verbal praise for nutritious food intake and physical activity	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved $3,000 Cost effective and potentially cost saving
Reduction in TV advertising of high fat and/or high sugar foods and beverages directed at children From ACE study	Australia	Preclude advertising of high sugar and/or high fat foods and beverages or fast food outlets during television viewing hours where a substantial proportion of children up to the age of 14 are in the viewing audience	Cost effectiveness under a number of scenarios. Incremental cost per incremental disability adjusted life year (DALY) saved	Gross cost per DALY saved: $3.70 Cost-effective and cost saving
Kids – 'Go for your life'	Australia	It is a setting based health promotion intervention that aims to reduce the risk of childhood obesity using an award-based program to improve the socio-cultural, policy and physical environments related to healthy eating and physical activity across the community. The key obesity-related behaviours targeted are: increasing fruit, vegetable and water consumption; reducing consumption of foods high in fat, salt and sugar and sweet drinks; increasing participation in physical activity; reducing sedentary behaviour and increasing active transport	Full evaluation of cost effectiveness has not yet been completed. Issue with a lack of control group	Not yet available

Programme	Country	Programme Description	Methodology	Result
Active travel – research for UK DfT	UK	Based on a canal towpath in London which was transformed into a high quality route for active travel.	Assessed in terms of levels of walking and cycling commuter use. User counts were conducted pre-project in 2002 and post-project in 2004.	BCR of 24.5:1 Savings of £5,487,130 through reduced absenteeism Savings of £28,537,854 due to increased physical fitness (based on numbers of preventable deaths)
Active travel – Links to Schools Schemes	UK - Leeds Sustrans, the Institute for Transport Studies at Leeds University and the University of Bolton	Bootle: scheme consisted of a series of improvements to an existing route close to a number of schools. The improvements include resurfacing, some new construction, road marking, signing and lighting. Hartlepool: involved the construction of a toucan crossing close to a primary and a secondary school, with some more general infrastructure improvements in the immediate vicinity. Newhaven: a new shared use path in an existing grassed verge adjacent to, and set back from, the busy A259 was constructed. The route is some distance from, but forms a link between, two secondary schools. It also links to their communities of Seaford and Newhaven	Cost benefit analysis using DfT guidance	BCR: 29.3:1 BCR: 32.5:1 BCR: 14.9: 1
Active Travel Cycling for England – research by SQW	England	Review of a number of cycling programmes and modelling conducted by SQW to determine the benefits of increased cycling.	SQW modelling and cost benefit analysis using DfT guidance	BCR: 2.59:1
Average of international active travel programmes	Denmark, New Zealand, Norway, USA and WHO research	Collation of evidence for active travel programmes including cycle network infrastructure, cycle and pedestrian routes, safety improvements	Cost benefit analysis	Median BCR: 8:1
Walk Once a Week	UK	Children participating in WoW are encouraged to walk to and/or from school at least once per week. The children keep a record of their participation by completing a diary or wallchart. If a child does this for one month they are rewarded with a collectable metal badge	Cost benefit analysis http://www.walktoschool.org.uk/cms-files/178-wavehill_-_wow_report_-_final_.pdf	BCR: 3.1 Costs: £900,000 Benefits: £2,800,000

References

Aos, S. Lieb, R. Mayfield, J. Miller, M and Pennucci, A. 2004. "Benefits and Costs of Prevention and Early Intervention Programs for Youth". Washington State Institute for Public Policy.

Bond, M. Wyatt, K. Lloyd, J. Welch, K. and Taylor, R. 2009. "Systematic review of the effectiveness and cost-effectiveness of weight management schemes for the under fives: a short report". Health Technology Assessment. Vol 13. No 61.

Boxall, A. 2009. "Obesity prevention in young children: what does the evidence say?". Australian Parliamentary Library. http://www.aph.gov.au/Library/pubs/bn/2008-09/ObesityChildren.htm

Birch, L. 2009. "An evaluation to review the effectiveness of an established residential weight management intervention on short-term health outcomes in overweight and obese children and adolescents". Dissertation for University of Chester.

Buckingham 2009 "The Impact of the Commercial World on Children's wellbeing - Technical Appendix K Children, Commerce, and Obesity: What Role Does Marketing Play?"

Cawley, J. 2010. "The Economics of Childhood Obesity," Health Affairs.

Christakis, N. Fowler, J. 2007. "The spread of obesity in a large social network over 32 years" Harvard Medical School.

City University of New York and London Metropolitan University. 2010. "A Tale of Two ObesCities: Comparing responses to childhood obesity in London and New York City, Municipal responses to Childhood Obesity."

Colquhoun D, Wright N, Pike J, Gatenby L. 2008. "Evaluation of Eat Well Do Well, Kingston upon Hull's school meal initiative." The University of Hull.

Crawford D, et al. 2008. "Neighbourhood fast food outlets and obesity in children and adults: the CLAN study". International Journal of Paediatric Obesity, Vol 3, number 4 2008, pp. 249-256 (8)

Currie J, et al. 2009 "The effect of fast food restaurants on obesity and weight gain". NBER working paper no. 14721

Davis, A. 2010. "Value for Money: An Economic Assessment of Investment in Walking and Cycling". Department of Health and Government Office for the South West.

Department of Health. 2010. "Healthy Weight, Healthy Lives: Two years on".

Department of Health (2008): Department of Health, 'Healthy weight, healthy lives: a toolkit for developing local strategies'.

Department of Health and Department of Children, Schools and Families. 2008. "Healthy Weight, Healthy Lives: A Cross-Government Strategy for England".

Doak, C.M. Visscher, T.L.S. Renders, C.M. and Seidell, J.C. 2006. "The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes". Obesity Reviews 7, 111-136.

Dollahite, H. Kenkel, D. and Thompson, S. 2008. "An Economic Evaluation of the Expanded Food and Nutrition Education Program. Journal of Nutrition Education and Behavior Volume 40 (3)

Dolton P. 2009. "Childhood obesity in the UK". Royal Holloway College, University of London.

Flodgren, G. Deane, K. Dickinson, H. Kirk, S. Alberti, H. Beyer, F. Brown, J. Penney, T. Summerbell, C. and Eccles, M. 2010. "Interventions to change the behaviour of health professionals and the organisation of care to promote weight reduction in overweight and obese people". The Cochrane Library, 2010, Issue 4.

Foresight. 2007 Tackling Obesities: Future Choices – Project Report. http://www.foresight.gov.uk/Obesity/17.pdf

Foresight (2007): Foresight, 'Tackling Obesities: Future Choices – Project Report', 2nd Edition.

Frontier Economics. 2010. "Estimating the costs of health inequalities: A report prepared for the Marmot Review".

Ganz, M. 2003. "The Economic Evaluation of Obesity Interventions: Its Time Has Come". Obesity Research Vol 11 No 11: 1275-1277.

Gentile, D. Welk, G. Eisenmann, J. Reimer, R. Walsh, D. Russell, D. Callahan, R. Walsh, M. Strickland, S. and Frtiz, K. 2009. "Evaluation of a multiple ecological level child obesity prevention program: Switch what you Do, View and Chew". BMC Medicine 7:49. Accessible at: http://www.biomedcentral.com/content/pdf/1741-7015-7-49.pdf

Greater London Authority, 2009. "The Young Londoner's Survey".

Greater London Authority. 2010. "Focus on London: health, Children and Young People".

GLA Economics, Early Years Interventions to address Health Inequalities in London - the Economic Case, January 2011, accessible at: http://www.london.gov.uk/who-runs-london/mayor/publication/early-years-interventions-economic-case

Haby, M. Vos, T. Carter, R. Moodie, M. Markwick, A. Magnus, A. Tay-Teo, K-S. and Swinburn, B. 2006. "A new approach to assessing the health benefit from obesity interventions in children and adolescents: the assessing cost-effectiveness in obesity project". International Journal of Obesity 30, 1463-1475.

Health and Social Care Information Centre, Lifestyles Statistics 2009. Health Survey for England 2008.

Higgs, R. 2010. "Obesity: Lifestyle counselling ineffective in tackling childhood obesity". Nature Reviews Gastroenterology and Hepatology 7, 67.

House of Commons (2004): House of Commons Select Committee on Health, Third Report. "Annex 1: The economic costs of obesity: A note prepared by the Scrutiny Unit, Clerk's Department ", 2004.

Johnson, E. et al (2006): E. Johnson, M.M. McInnes, J.A. Shinogle, 'What is the economic cost of overweight children?', Eastern Econonic Journal, Vol. 32, No.1, Winter 2006.

Jurgen, J. Wenig, C. Wolfenstetter, S. 2010. "Recent economic findings on childhood obesity: cost-of-illness and cost-effectiveness of interventions". Current Opinion in Clinical Nutrition and Metabolic Care Vol 13(3):305-313.

Kipping, R. Jago, R. and Lawlor, D. 2008. "Obesity in children: Part 1: Epidemiology, measurement, risk factors and screening". BMJ; 337:a1824

Livingstone, M. McCaffrey, T. and Rennie, K. 2006. "Childhood obesity prevention studies: lessons learned and to be learned". Public Health Nutrition 9(8): 1121-1129.

Lock, K. Stuckler, D. Charlesworth, K. McKee, M. 2009. "Potential causes and health effect of rising global food prices". BMJ 339:269-72.

London Health Observatory 2009. "Weighty Matters: The London findings of the National Child Measurement Programme 2006 to 2008".

London Health Observatory. 2010. "Causes of childhood obesity in London: diversity or poverty?".

Ludwig, D. 2007. "Childhood Obesity – The Shape of Things to Come". The New England Journal of Medicine 357:23

McAuley,K. Taylor, R. Farmer, V. Hansen, P. Williams, S. Booker, C. and Mann, J. 2009. "Economic Evaluation of a Community-based Obesity Prevention Program in Children: The APPLE Project". Obesity 18, 131-136.

McCormick, B. Stone, I. and Corporate Analytical Team. 2007. "Economic costs of obesity and the case for government intervention". Obesity reviews 8 (Suppl.1), 161-164

McPherson, K and Brown,M. 2009. "Social Class and Obesity – Effects on disease and health service treatment costs". Report to Anna Coote and Michael Marmot for consideration in the Marmot Review: Fair Society, Healthy Lives.

McPherson, K. Marsh, T. and Brown, M. 2007. "Foresight Tackling Obesities: Future Choices – Modelling Future Trends in Obesity and the Impact of Health". 2nd Edition.

Moran, R. 1999. "Evaluation and Treatment of Childhood Obesity". American Academy of Family Physicians.

National Audit Office. 2001. "Tackling Obesity in England".

National Heart Forum, 2009. "Obesity Trends for Children Aged 2-11 Analysis from the Health Survey for England 1993 – 2007".

National Heart, Lung, and Blood Institute. 1998. "Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report". National Institutes of Health Publication No. 98-4083.

NICE, Obesity: the prevention, identification, assessment and management of overweight and obesity in adults and children; December 2006; available at: http://www.nice.org.uk/nicemedia/live/11000/38159/38159.doc

NMHRC (National Medical Health and Research Council). 2003. "Clinical Practice Guidelines for the Management of Overweight and Obesity in Children and Adolescents". Commonwealth of Australia. Accessible at: http://www.health.gov.au/internet/main/publishing.nsf/Content/893169B10DD846FCCA256F190003BADA/$File/children.pdf

National Obesity Observatory. 2009. "National Child Measurement Programme: detailed analysis of the 2007/08 national dataset".

National Obesity Observatory. 2010. Key data briefings

National Opinion Poll (Ofcom). 2004. "Childhood obesity food advertising in context".

Natural England. 2009. "Childhood and Nature: A survey on changing relationships with nature across generations".

Ofsted. 2008. "TellUs3" reports by Local Authority.

ONS. 2010. "Regional Health Inequalities in England". Regional Trends. No 42.

Parliamentary Office of Science and Technology (2003) "Childhood Obesity". Postnote September 2003, Number 205.

Peninsular Medical School. 2008. Earlybird Diabetes Study.

Playday. 2010. "Our Place".

Policy Exchange. 2008. "Weighing in: Dealing with the challenge of obesity". Research note

Rudolf, M. Christie, D. McElhone, S. Sahota, P. Dixey, R. Walker, J. and Wellings, C. 2006. "WATCH IT: a community based programme for obese children and adolescents". Archives of Disease in Childhood Vol 91(9):736:739.

Sacher, P. Kolotourou, M. Chadwick, P. Cole, T. Lawson, M. Lucas, A. and Singhal, A. (2010). "Randomised Controlled Trial of the MEND Program: A Family-based Community Intervention for Childhood Obesity". Obesity
Vol 18:2.

Saha, S. Gerdtham, U. and Johansson, P. 2010. "Economic Evaluation of Lifestyle Interventions for Preventing Diabetes and Cardiovascular Diseases". International Journal of Environmental Research and Public Health. Vol 7(8): 3150-3195.

Sallis, JF. Glanz, K. 2006. "The role of built environments in physical activity, eating and obesity in childhood. The future of children.

Sassi, F for OECD. 2010. "Obesity and the Economics of Prevention: Fit not Fat". Accessible at: http://www.oecd.org/document/31/0,3343,en_2649_33929_45999775_1_1_1_1,00.html

School Food Trust. 2010. "Take-up of school lunches in England 2009/10".

http://www.schoolfoodtrust.org.uk/news-events/news/canteen-biggest-barrier-to-healthy-eating-for-kids

Simonetti D'Arca, A. Tarsitani, G. Cairella, M. Siani, V. De Filippis, S. Mancinelli, S. Marazzi, M. and Palombi, L. "Prevention of obesity in elementary and nursery school children". Public Health. Vol 100, Issue 3:166-173.

Skuoteris, H. McCabe, M. Swinburn, B. and Hill, B. 2010. "Healthy eating and obesity prevention for preschoolers: a randomised controlled trial". BMC Public Health 10:220.

Skuoteris, H. McCabe, M. Swinburn, B. Newgreen, V. Sacher, P. and Chadwick, P. 2010. "Parental influence and obesity prevention in pre-schoolers: a systematic review of interventions". Obesity reviews.

Summerbell CD, Waters E, Edmunds L, Kelly SAM, Brown T, Campbell KJ. Interventions for preventing obesity in children. Cochrane Database of Systematic Reviews 2005, Issue 3

Sutcliffe, TJ. et al. 2003. "Children and Healthy Eating: A systematic review of barriers and facilitators". EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

Swanson, K. 2008. "Healthy Weight, Healthy Lives: A toolkit for developing local strategies". http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_088967.pdf

Swinburn, B. Jolley, D. Kremer, P. Salbe, A. and Ravussin, E. "Estimating the effects of energy imbalance on changes in body weight in children". American Journal of Clinical Nutrition 83:11-17.

Techankehakij, W. and Hutton, J. 2010. "Economic Evaluation of the National Child Weight Management Programme: MEND 7-13". York Health Economics Consortium.

Thomas J, Sutcliffe K, Harden A, Oakley A, Oliver S, Rees R, Brunton G, Kavanagh J. 2003. "Children and Healthy Eating: A systematic review of barriers and facilitators." London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London

Trueman, P. Haynes, S. Lyons, F. McCombie, L. McQuigg, M. Mongia, S. Noble, P. Quinn, M. Ross, H. Thompson, F. Broom, J. Laws, R. Reckless, J. Kumar, S. Lean, M. Frost, G. Finer, N. Haslam, D. Morrison, D and Sloan, B. 2010. "Long term cost-effectiveness of weight management in primary care". International Journal of Clinical Practice Vol 64(6):775-783.

Trueman P and Flack S. 2006. "Economic Evaluation of Weight Watchers in the prevention of obesity". Clinical Excellence.

Victorian Government Department of Human Services. 2006. "ACE-Obesity: Assessing Cost-effectiveness of obesity interventions in children and adolescents. Summary of Results". Melbourne, Australia.

Wang, L. Yang, Q. Lowry, R. and Wechsler, H. 2003. "Economic Analysis of a School-Based Obesity Prevention Program". Obesity Research Vol.11 No 11:1313-1324.

Warren, J. Henry, C. Lightowler, H. Bradshaw, S and Perwaiz, S. 2003. "Evaluation of a pilot school programme aimed at the prevention of obesity in children". Health Promotion International Vol 18(4):287-296.

WHO Consultation on Obesity, 2000; p134

York Health Economics Consortium and nef consulting. 2010. "The social and economic value of the Mend 7-13 programme".

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Hindi

यदि आप इस दस्तावेज की प्रति अपनी भाषा में चाहते हैं, तो कृपया निम्नलिखित नंबर पर फोन करें अथवा नीचे दिये गये पते पर संपर्क करें

Vietnamese

Nếu bạn muốn có văn bản tài liệu này bằng ngôn ngữ của mình, hãy liên hệ theo số điện thoại hoặc địa chỉ dưới đây.

Bengali

আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি (কপি) চান, তা হলে নীচের ফোন্ নম্বরে বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Greek

Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος εγγράφου στη δική σας γλώσσα, παρακαλείστε να επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυδρομικά στην παρακάτω διεύθυνση.

اگر آپ اِس دستاویز کی نقل اپنی زبان میں چاھتے ھیں، تو براہ کرم نیچے دئے گئے نمبر پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

Turkish

Bu belgenin kendi dilinizde hazırlanmış bir nüshasını edinmek için, lütfen aşağıdaki telefon numarasını arayınız veya adrese başvurunuz.

Arabic

إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى الاتصال برقم الهاتف أو مراسلة العنوان أدناه

Punjabi

ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫ਼ੋਨ ਕਰੋ ਜਾਂ ਹੇਠ ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

Gujarati

જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.

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