Obesity and socio-economic groups in Europe: Evidence review and implications for action

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The contract specified a report entitled "*Obesity and socio-economic group in Europe: State of the art review and implications for action. The aims of this state of the art review are: to bring together information on the relationship between obesity and trends in obesity in relation to socio-economic groups in the European Population; to review evaluations of policy measures and interventions to tackle obesity which take into account variations in prevalence by socio-economic group; to make recommendations relevant to policies at European and national levels."*

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Executive summary

In the EU White paper "*A strategy for Europe on Nutrition, Overweight and Obesity Related issues*" it is stated that "*In 2007 the Commission will finance a study looking at the relationship between obesity and socio-economic status with a view to considering the most effective interventions to tackle those in low socio-economic groups.*"

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This review attempts to answer the questions:
Are there inequalities in obesity prevalence between socio-economic groups?
What are the determinants of these inequalities in obesity?
What has been done to reduce these inequalities in obesity?
What more needs to be done?

To answer these questions, we examined the following types of evidence: Systematic reviews of controlled interventions and other interventions; National evidence-based guidelines for reducing obesity; The Medline database 1997-2007 using search terms 'obesity', 'prevention' or 'intervention' and 'inequality' or 'socio-economic', considering papers primarily of European origin. This report brings together information on the extent of the social gradient in obesity and a review of explanatory hypotheses for associations found. This is followed by an overview of the evaluation of policy measures and interventions to reduce the social gradient in obesity. Finally recommendations are made in relation to the development of policies and actions to reduce levels of obesity at Member State and European level, along with a section identifying the key gaps in current knowledge.

In this document, socio-economic group is abbreviated to SEG, socio-economic status to SES, and the term 'lower' refers to lower income levels, less well-paid employment status, fewer years of academic schooling or similar social disadvantage. The term 'overweight' indicates those people with raised levels of adiposity likely to increase their risk of ill health, and 'obese' is those with a substantially raised level of adiposity and hence likely to display associated health problems. Other definitions and explanations are explained in the glossary at the end of this report.

Data was collated from international and national databases in section two for 18 countries and the extent of the association between obesity and socio-economic status in European populations is described. Obesity prevalence levels in adults and children have been increasing in virtually all Member States. Secular trends show that, apart from some countries in Eastern Europe, there has been a continuing and in some countries a widening gap between the levels of obesity prevalence among adults in higher and lower SEGs, with those in the lower SEGs showing higher prevalence levels. An unweighted crude estimate across 13 Member States suggests that **over 20% of the obesity found among men in**

Europe, and over 40% of the obesity found in women, is attributable to inequalities in SES – a figure similar to that estimated in the Eurothine study,[1] which estimated 26% and 50% of obesity prevalence for men and women respectively in Europe could be attributed to inequalities in educational status. **Obesity and overweight among children in Europe is also associated with the socio-economic status of their parents, especially their mothers**. Furthermore, cross-country comparisons show the prevalence of **childhood overweight is linked to a Member State's degree of income inequality or relative poverty**.

Section 3 reviews the scientific evidence regarding the causal links likely to explain the trends shown in section 2. Many determinants of obesity appear to show a social gradient, both in terms of the health behaviour shown by members of different SEGs and the environments where people live and work. Dietary and physical activity patterns of lower SEGs show greater risk of positive energy balance (food energy intake exceeds energy output). Foods eaten by the lower SEGs are higher in energy and lower in micronutrients compared with higher SEGs. Members of lower SEGs eat less vegetables and fruit and children drink more soft drinks than those from higher SEGs. In general, adults and children, especially girls, from lower SEGs are less active and more sedentary.

Women in lower SEGs may be more vulnerable than men to developing obesity because they are subjected to different environmental pressures including; less physical activity; pregnancy; discrimination in employment and income; responsible for family budget; and lower self-esteem associated with a failure to meet societal norms. **Women in lower SEGs are more likely to have either under- or over-weight babies** (both risk factors for later obesity) **and are less likely to follow recommended breastfeeding and infant feeding practices** (also linked to obesity risk).

After carrying out a comprehensive review of the scientific literature, section 4 considers the actions that have been undertaken to try to reduce the social gradient in obesity. It reviews interventions which targeted social groups in which obesity is higher or which have evaluated the impact of an intervention by social or economic group. In addition national evidence-based recommendations are examined for their guidance on reducing inequalities in obesity. It appears there are **very few controlled interventions that have targeted lower socio-economic groups or have examined the effect of interventions on different socio-economic groups**. Where evidence is available, it shows that participants from lower income groups are likely to show less response to health promotion programmes and have higher drop-out rates. Interventions are often of short duration and **fail to take sufficient account of ethnic and social diversity**.

The evidence suggests that **educational information alone is relatively ineffective among lower income groups and may increase inequalities.** However, there is evidence that breastfeeding support programmes can be effective for women in less affluent groups. **More focussed intervention could be offered through maternal and child health care and social support services** since this may have a beneficial impact on reducing the social gradient in obesity. However the design of services must be carefully considered as to how best to **engage these women** and evaluations of these interventions are needed.

In section 5 the literature is reviewed and the policies and actions needed to tackle obesity inequalities at Member State and European level are discussed. It finds that **a minority of Member States show awareness of the links between SES and obesity** in their major inequalities and social exclusion policy documents. Given that the health sector alone is

unlikely to reduce the social gradient in obesity **cross-sectoral population-wide policies are needed**. For example: agriculture and food supply; improved availability and access to affordable healthy food and physical activity; welfare policies and social benefits; fiscal policies, such as subsidies and taxes; and controls on marketing.

Policy-makers may benefit from studying the literature on the limitations of health education as a means of inducing behaviour change, the value of participatory policy-making in order to gain stakeholder support, and to develop models of social development which integrate sustainable economies with the reduction of health inequalities.

The report concludes with section 6 where gaps in current knowledge are identified and measures are recommended to fill these gaps. **Firstly more evidence is needed concerning the mechanisms of how food and nutrition insecurity and obesity can co-exist within the same groups in society.** For example the percentage of **disposable income and the absolute amount spent on food** by members of different SEGs **should be calculated** for each country. **This amount can be compared with both the cost of a healthy food basket and the level of obesity within different SEGs**.

Secondly new **dietary and physical activity guidelines are needed** in Europe **so that maternal and young child health and welfare services can provide improved and appropriate support for disadvantaged reproductive-age women**.

Thirdly there is a need for better monitoring of: measured heights and weights across the lifespan; and the determinants of obesity, such as analysis of food and physical activity indices. These data should be easily accessible from Member States. These surveillance data provide the basis for setting targets to reduce the social gradient in obesity and will enable the evaluation of interventions and policies in different Member States.

For policy makers to be able to invest in health promotion, **more evidence of the reach and penetration of interventions in lower income groups is needed**. **The cost of interventions also needs to be reported in order to estimate cost-effectiveness of health improvement strategies.**

1 Conclusions and recommendations

A combination of factors are contributing to the socio-economic gradient in obesity (and related diseases) including biological, ethnic/genetic, psychological, educational and economic factors, of which those most open to cost-effective intervention are the educational and economic factors. These are largely mediated through the individual's environment – their social and economic resources, their built environment and their access to the resources necessary for good health, including affordable and available health-promoting environments for physical activity and for nourishing food. Access to such environments is in turn determined by policies in a range of sectors including fiscal, social and health.

In the course of the preparation of this review it became clear that in most countries, except some Nordic countries, the social gradient in obesity affects women much more than men and applies also to children. Children reflect current and very recent environmental influences on health – i.e. they demonstrate that the modern-day social, physical and economic environment has an obesogenic influence and that SES mediates this influence. The researchers also took the view that, while some short-term measures may be able to influence the current level of obesity in the population to a small degree, long-term sustainable reduction in the levels of obesity in Europe is likely to be achieved only by implementing targeted interventions across the lifespan, combined with population-wide strategies.

As a result, this review attempts to add value to the debate by analysing the social gradient in obesity using a life course approach. This considers the inter-generational and developmental aspects of the biology of health and obesity, and focuses attention on interventions and policies to ensure that women of reproductive age have optimum nutritional status and that child-rearing skills ensure the best obtainable nutritional health for children. A reduction in the social gradient in obesity therefore requires, amongst other things, a greater focus on the reduction of nutritional health inequalities in reproductive-age women and children.

1.1 Policy shortcomings

Although all 27 EU Member States have a National Action Plan against Poverty and Social Exclusion (NAPS) and 17 countries have policies on the Health Inequalities Portal, many of these policies do not address the social gradient related to obesity and only 5 Member States included obesity in relation to health inequalities in both their NAPS and healthy policies. More awareness and stronger collaboration between the social and health sectors is recommended in order to address the social gradient associated with obesity. A special initiative generated by the European Commission's directorate for Employment, Social Affairs and Equal Opportunities and DG SANCO using the Open Method of Coordination and NAPS could facilitate the establishment of a reporting system and improved collaboration between the relavent sectors both nationally and at EU level.

1.2 The co-existence of obesity and food and nutrition insecurity

High rates of obesity are assumed to be the result of eating too much food. In contrast poverty is assumed to result in the lack of food energy (food insecurity), hunger and starvation. The evidence presented in this report suggests that food and nutrition insecurity and obesity can co-exist in the same communities and possibly in the same individuals, a

phenomenon that appears to have gone relatively unnoticed. Food that requires few skills to prepare is tasty and above all satisfies hunger and is likely to be processed, such as snack foods, soft drink beverages, and fast food. A diet of such foods is likely to be poor in vitamins, minerals, anti-oxidants, phyto-chemicals and other essential nutrients but be less expensive and rich in energy. Thus instead of becoming thin, these people become fat and poorly nourished. This appears in many countries to be more marked in women and children.

The little information that exists concerning the association between obesity and nutrition insecurity in less-privileged societies emphasises the costs of different types of food and especially the relative cheapness of foods rich in fats and sugars compared with those rich in micronutrients, such as fresh fruits and vegetables. More evidence is needed to confirm the co-existence of obesity and food and nutrition insecurity in low income groups in EU countries. This is an area that urgently needs more attention.

1.3 Monitoring and targets

The paucity and poor quality of data on obesity prevalence according to SEG, especially among children, indicates that a European surveillance system is needed to monitor the health indicators related to obesity, food and nutrition insecurity and physical activity. These indicators can help to establish what income levels are needed in each country to ensure families can afford a healthy diet and be physically active. In addition more understanding of how poverty and food and nutrition insecurity are related to obesity is needed to ensure that the most effective interventions are implemented. More social research and new indicators are also needed to understand how low income families cope within their social environment. Monitoring the weight of reproductive age women and children should be undertaken in each European country, and targets set to guide government policy and give direction to all stakeholders, including industry and consumers.

1.4 Population-wide action combined with life-course approach

The effects of different determinants across the life-course is analysed in this review. It appears that a woman's reproductive health and the health of her off-spring are more vulnerable to the risk of obesity than currently perceived. Maternal obesity is a key determinant of the next generation's health. Women in lower SEGs may be more vulnerable than men to obesity because of: discrimination in employment and income; gatekeeper of family budget; less physical activity; pregnancy; and resulting lower self-esteem. An infant with an obese mother is more likely to: have a high birthweight; be at higher risk of being an obese child; and become an obese adult. Population-wide policies such as access to paid maternity leave; healthy school meals; fruit and vegetable schemes and pre-school child care facilities combined with targeted interventions using a life-course approach are recommended to halt the increasing social gradient in obesity.

1.5 Maternal and infant health

Obesity prevalence levels for women and children are rising, there are significant SEG gradients and in many countries these gradients appear to be increasing. However more evidence is needed to confirm this on an EU-wide basis.

Pregnancy is a critical life-course event yet few guidelines for nutrition, physical activity and weight gain during pregnancy have been implemented systematically within European countries. Future investigations need to consider how best to address weight gain before,

during and after pregnancy. Research findings suggest that maternal obesity is associated with short breastfeeding duration and obese women require additional support to implement the existing European infant feeding guidelines. Dietary and physical activity guidelines could be implemented via maternal and child services. This would involve courses for health professionals dealing with weight management, healthy eating and physical activity at affordable prices, and support healthy taste development in infants through correct feeding practices. These services should be supported by social and welfare policies that ensure diet and physical activity advice can be easily implemented by less privileged women.

1.6 Child health

The association between childhood obesity and children living in poverty in Europe appears to be strong. Obese children may be unable to enjoy normal cognitive development and their ability to learn optimally may be hampered because of a high-energy, low nutrient diet. It is likely that the rate of return of investing in health promotion while a child is young is higher than the rate of the same financial investment made at a later age. Early investment in pre-school is harvested over a longer period of time but also because the nature of early learning and early cognitive development can facilitate later learning.

Implementation of comprehensive pre-school school and health policies, including access to healthy meals and physical activity, are shown to improve children's health and learning potential. Girls in particular show a marked decrease in physical activity at school, and school policies should therefore ensure physical education lessons are attractive to girls, especially those from lower socio-economic and ethnic backgrounds.

1.7 Adults and older people

Adults on low incomes tend to be less likely to consume healthy foods and are less active. It is essential to design interventions that prevent adult obesity because cost-effectiveness of preventing obesity continuously improves with age, right up to older age-groups. The sharpest increase in the incidence of obesity appears to occur in adulthood and adults usually continue to gain weight during adulthood. Older people show reduced overweight and obesity prevalence levels probably partly due to a healthier lifestyle during their younger years. Therefore the implementation of interventions and policies that support healthier dietary and physical activity patterns throughout the lifespan will help foster "*Good Health in an Ageing Europe"*one of the main aims of the EU Health Strategy *'Together for Health: A Strategic Approach for the EU 2008-2013*'. In addition the potential of the sport sector in supporting the EU's strategic ambitions in the fight against overweight and obesity is recognized within the EU´s White Paper on sport.

1.8 Coordination mechanisms

Strong coordination mechanisms between ministries responsible for Education, Social and Health services are paramount. In addition, policies at EU level, for example relating to Agriculture, Employment and Social Affairs, should be in accord with health. Policy tools such as regulatory and legislative powers of EU directives to control the food supply chain can help create demand for fresh nutritious food. The regulatory powers of national governments can create incentives through, for example, planning powers for regulating the built environment and through public sector food procurement contracts to create a market for a sustainable nutritious food supply.

EU and national policy makers need a strategic multi-sectoral framework, underpinned by income levels and nutritional and physical activity targets. The framework should make explicit each stakeholder's role and responsibility in implementing specific assessments of all relevant policies. A "Concordat" could be signed between the different governmental departments and overseen by a committee that clarifies who has responsibility for what. Implementation will need evaluation at local, national, and EU level. Indeed in the EU White paper on nutrition it is stated: "*The Commission will set up a High Level Group focused on nutrition and physical activity related health issues. The objective of the Group would be to ensure that the exchange of policy ideas and practices between Member States takes place, with an overview of all government policies.*"

Reducing the prevalence of obesity should become one of the aims for social and health policies in Europe. Specific targets should be established to reduce the social gradient in obesity, especially relating to a healthy body weight in women before and during their reproductive years. The particularly high levels of maternal and childhood obesity associated with food and nutrition insecurity appears to have been overlooked in many countries. Progress has been made to reduce smoking levels and similar achievements can be made and, although more challenging than smoking, the benefits to society of reducing levels of obesity could be even greater.

1.9 All of society involvement

The need to change dietary and physical activity behaviour and prevent chronic diseases should focus on how best to prevent food and nutrition insecurity and improve access to safe, daily physical activity. These policies require the support and involvement of society as a whole and require policy concordance between the sectors responsible for food, physical activity and health across all stages of the lifespan. This approach offers the best solution to reduce the prevalence obesity in the whole population and to reduce the social gradient related to obesity.

The obesity gap between the richest and poorest appears to be widening and current policies may make things worse by polarising society into the well-off lean and the less-privileged obese. For example, the better-off are more likely to respond to health education campaigns than poorer people.[2] The existence of a steep social gradient in obesity prevalence has important implications for policy makers. The Lisbon Agenda's aim that the EU can become the most dynamic knowledge-based economy in the world will be hampered if this issue is not addressed. Strategies that stop the increasing prevalence of obesity and its social and health consequences are urgently required.

2 Epidemiology of obesity inequalities

This section reviews primary evidence on the relationship between levels of obesity according to social and economic groupings in European population and considers the evidence for socio-economic-related associations with the prevalence of obesity both within and between countries.

Added value has been given by considering the evidence, where available, on obesity among women of reproductive age and children. This has been undertaken to consider which interventions could be most cost-effective in reducing the current levels of obesity throughout the lifespan, especially through pregnancy and early child growth.

Main findings

- There is a consistent and profound social gradient in the prevalence of obesity in countries in Western Europe for which data are available. Women and children in lower socio-economic groups are especially likely to show high levels of obesity compared with the rest of the population. The gradient is less pronounced for men.
- In Eastern Europe the patterns are less clear with better off men and better-off older women showing higher levels of obesity compared with other adults. In some areas there may be a concurrent problem of underweight among younger women.
- Taking the region as a whole, available data suggests that some 20-25% of the obesity found in men, and some 40-50% of the obesity found in women can be attributed to differences in socio-economic status.
- In general the evidence suggests that the difference between socio-economic groups is widening, i.e. the gradient is becoming steeper.
- Obesity and overweight among children is also associated with the socio-economic status of their parents, although only a few studies are available.
- Members of older age groups (>60yr), according to the available data, show reduced overweight and obesity prevalence levels due to (a) a healthier lifestyle during their younger years and/or (b) a selective attrition due to higher mortality rates from diseases linked to obesity.
- Evidence of social inequalities within populations is matched by evidence between populations: those Member States with higher levels of social inequality (e.g. income inequalities or proportion of the population living in relative poverty) tend to have the highest levels of obesity in the population, especially among adolescents and among children.

2.1 Prevalence and trends in obesity inequalities

Drawing on evidence from the European region this section shows that, in general, obesity levels are rising among adults and children in virtually all population groups, but rising most rapidly for those in lower income, lower education and minority ethnic groups. The evidence available shows that the association between raised risk of overweight and lower socio-economic status is more clearly demonstrated for women and children than it is for men. Of particular concern are female adolescents and women of reproductive age, for whom social inequalities and raised risk of obesity can generate health problems for subsequent generations.

These generalisations, however, are based on a fragmented evidence base. Remarkably few countries have a sustained sequence of surveys able to demonstrate secular trends in socio-economic disparities for overweight and obesity. Furthermore, indicators of socio-economic status differ between countries, so that exact comparisons are difficult to make. As a result it may be premature to assume that obesity-related health differentials are genuinely increasing between socio-economic groups, although the information presented in this review suggests that this is the case.

In cross-sectional comparisons of national obesity prevalence figures, there appears to be a link between obesity prevalence and the distribution of wealth: those countries with the greatest inequality in wealth distribution have higher levels of prevailing obesity. This relationship is most clearly shown in wealthier countries and among women, children and adolescents. Further analyses are needed to identify the detailed links between health disparities and wealth inequalities and the degree to which obesity prevalence reflects other aspects of behavioural or environmental characteristics that are associated with income inequalities.

The evidence suggests that those countries with highest income levels combined with low inequality ratings, e.g. Sweden, are likely to have relatively low levels of child and adult obesity. The exception is found in countries experiencing severe economic recession, which is associated with static or falling levels of overweight and obesity.

However, it is unclear the degree to which different stages of economic development or different levels of income inequality can account for the differences in obesity prevalence between populations. Obesity prevalence is now increasing in virtually all countries in the European region for which data are available, including those with relatively egalitarian wealth distribution. This said, it is reasonable to speculate that, if all Europeans were to enjoy levels of income equivalent to the top SES categories in their country, and if their national wealth distribution levels matched those countries with the lowest inequalities, then the prevalence of obesity in Europe would be substantially lower.

The data presented here come from a variety of sources including national and cross-national programmes. Although not an ideal indicator of adiposity, most surveys report the Body Mass Index (BMI, weight in kilograms divided by the square of height in metres). Other measures, such as waist circumference and skinfold thickness may be more closely linked to the health effects of excess adiposity, while more complex techniques, such as image scanning and bio-impedance measures, may provide more exact determination of fatty tissue mass. However there is apparently little information on the relationships between the prevalence of high adiposity using these measures and socio-economic status of individuals.

BMI values can be categorised into under-weight, normal weight, overweight and obese and further into degrees of obesity. Although different definitions have been used in the past, most European countries now follow the World Health Organization definitions specified in the table below.

BMI is relatively easy to obtain from measurement or even from questionnaire although there are limitations to using self-reported measures as these tend to be distorted (women tend to under-report their weight, and men over-report their height, for example) and biases of up to 30% have been reported in the prevalence levels of obesity using self-reported heights and weights.

Table 2-1. Categories of adiposity according to BMI (adults)

Description	BMI (kg/m^2)
Underweight	under 18.5
Normal range	18.5 24.99
Overweight	25 or more
Obese	30 or more
sub-classifications:	
overweight pre-obese	25-29.99
moderately obese	30-34.99
severely obese	35-39.99
very severely obese	40 or more

Source: adapted from WHO 2000[3]

Note that there can be confusion about the use of the word 'overweight'. It may refer to all persons with a BMI of 25 or more, or it may refer only to those persons with a BMI between 25 and 29.99 (sometimes this is referred to as 'overweight non-obese' or 'pre-obese').

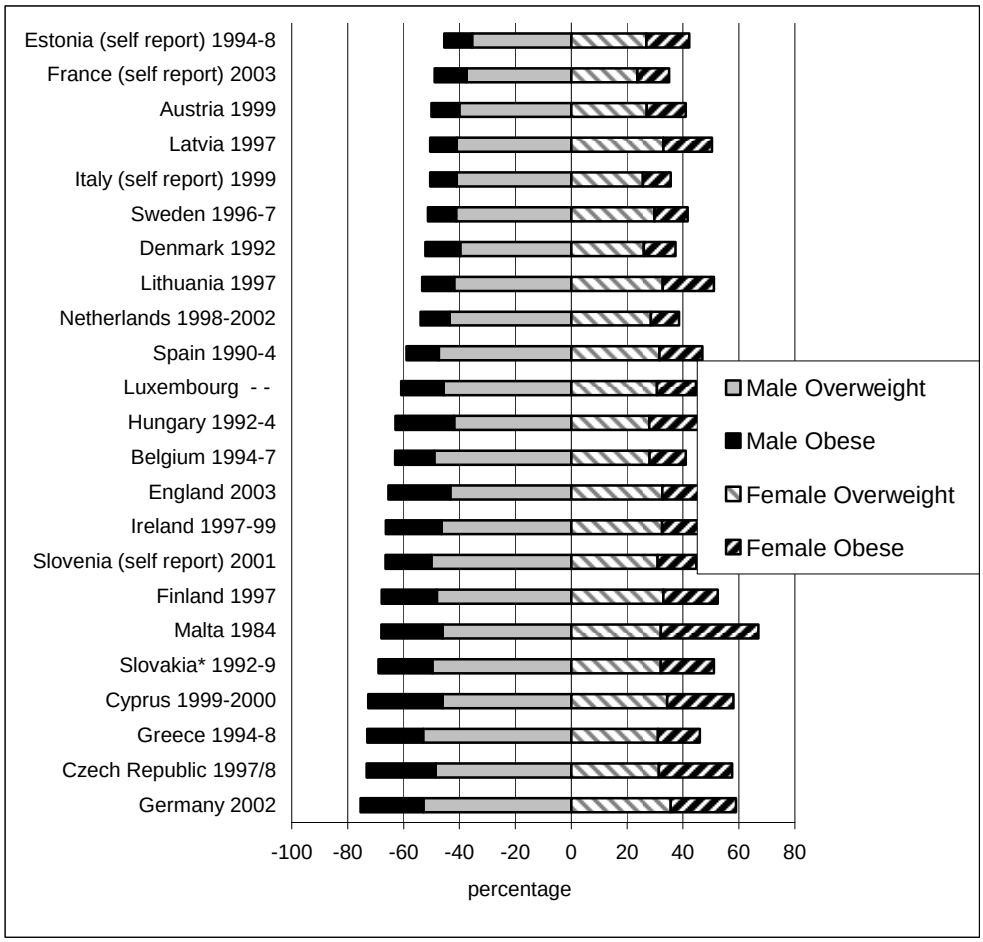
The BMI classifications given in table 2-1 apply to adults. They are not applied to children because weight and height measurements are changing through normal growth patterns. Several alternative approaches have been defined for measuring children: many countries apply age-based charts for weight, height and BMI based on a reference population, with excess adiposity defined as a BMI more than two standard deviations above the reference population's mean, or above the 95th centile of the population's BMI distribution. The reference population used in either of these two definitions may be a local population (for example the UK Department of Health uses child centiles based on data from English children in 1990) or one used as a reference population by the World Health Organization (these are now under review) or the USA. A different approach, which is increasingly being used for inter-country comparisons, is to take an internationally representative sample of children and to plot the BMI centile curves back from adulthood through childhood, equivalent to adult BMIs of 25 and 30. This provides a series of benchmarks linked to the adult definitions, adjusted for age and gender. The benchmark values have been published by Cole et al[4] and are recommended for comparison of child obesity prevalence statistics across different populations.

2.2 Summary prevalence data for Europe

There has been no comprehensive cross-national survey of obesity prevalence based on measured heights and weights among adults in the European region, although one co-ordinated study was undertaken for the MONICA project, which ran from the early 1980s to the mid-1990s and sampled populations in 38 locations in 21 countries worldwide.[5] Otherwise, estimates of the prevalence of obesity and overweight are based on surveys of national and sub-national samples collected by a range of institutions as part of government and research institute health survey activities. The International Obesity Task Force (IOTF) collates relevant and comparable figures from published and unpublished surveys. In addition, estimates of the prevalence of adult obesity are provided by the World Health Organization (WHO) for their online non-communicable disease database. A summary of recent surveys produced by the International Obesity Task Force for the

launch of the European Commission's Platform on Diet, Physical Activity and Health in 2005 is shown in Figure 2 -1.

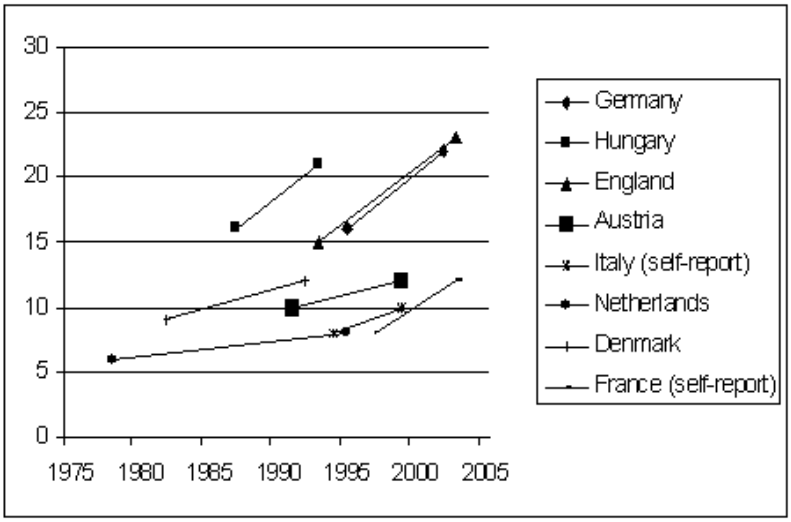
Figure 2-1 Adult overweight (BMI 25-29.99) and obesity (BMI>30) for selected countries in the European Union.



Source: IOTF (http://www.iotf.org/database/index.asp (*Slovakia: IOTF estimate based on measured data).
Notes: Age range & years differ & prevalence figures are not age standardised; self reported surveys may underestimate true prevalence.

Using historical survey data, countries in Europe have shown a rapid increase in the prevalence of overweight and obesity. Examples are shown in Figure 2-2.

Figure 2-2. Rising levels of obesity prevalence among adults in European countries

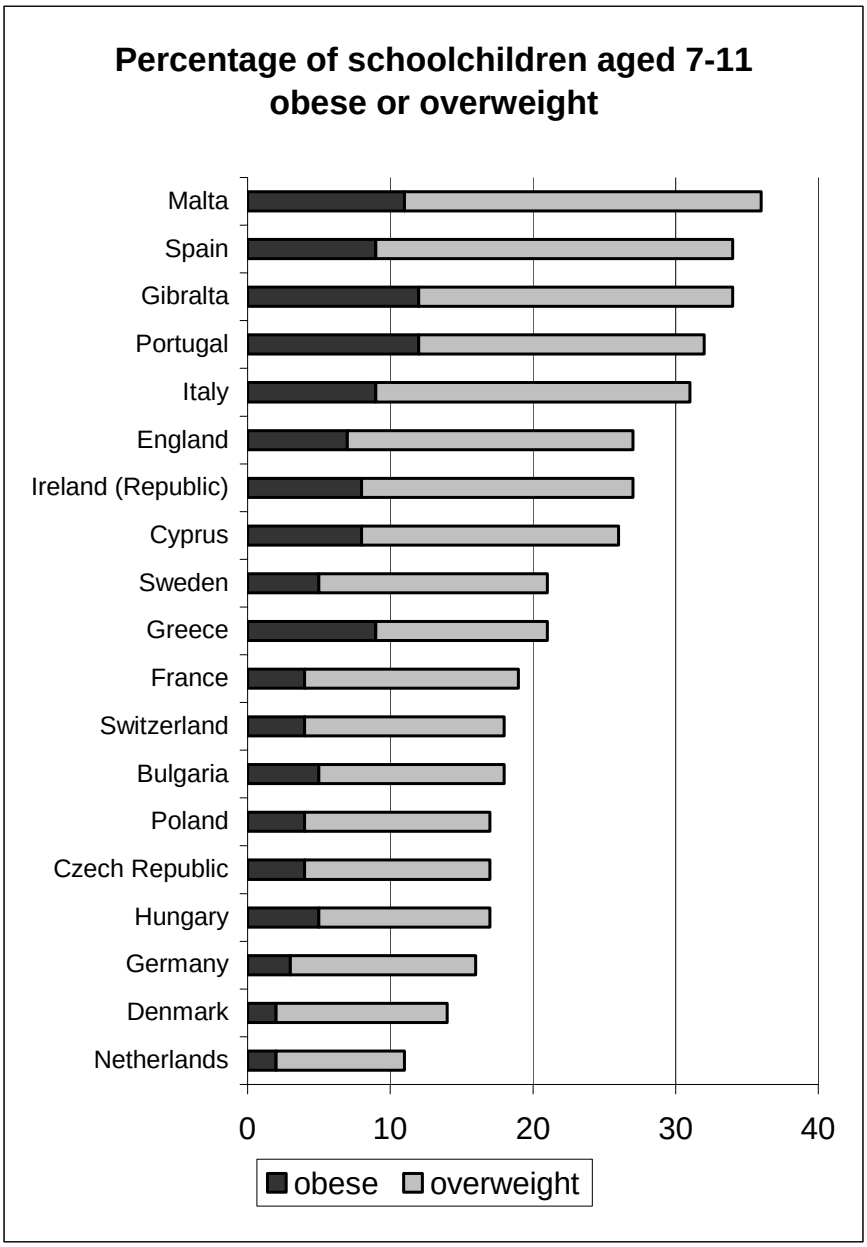


Source: IOTF (http://www.iotf.org/database/index.asp) Note: Definition'adult' may differ between countries

2.3 Child obesity

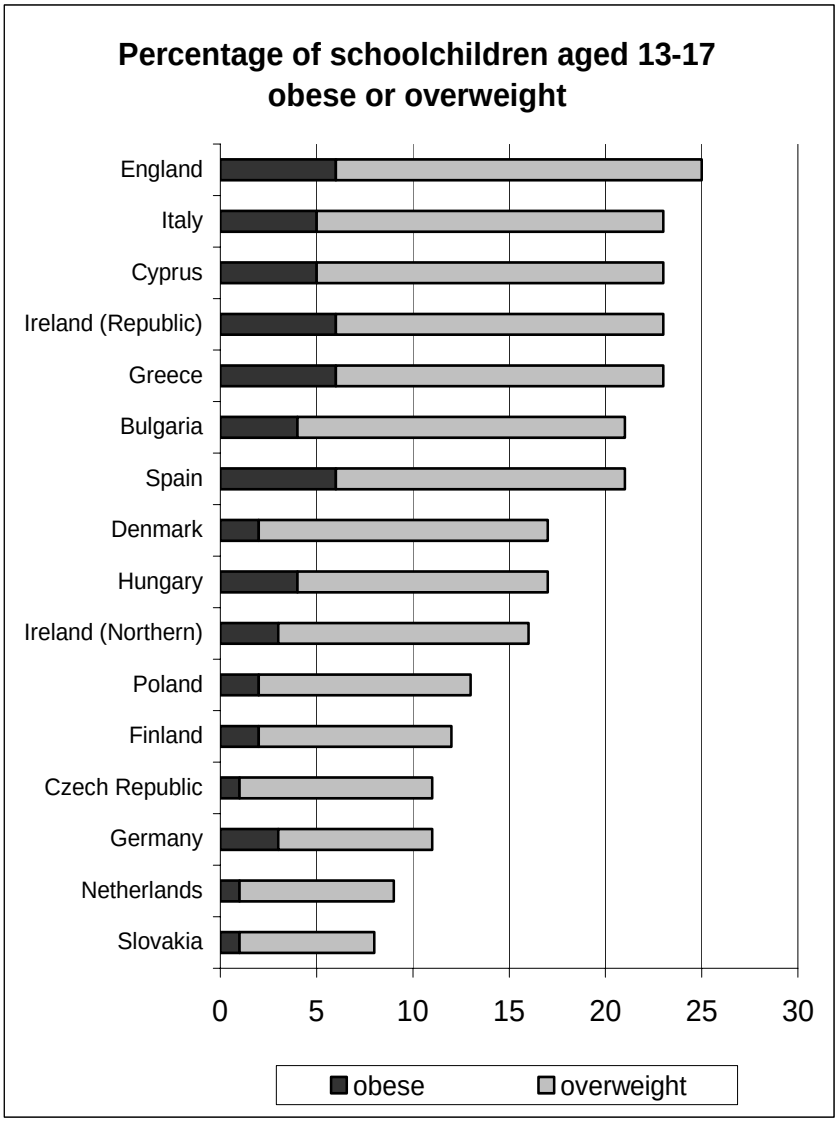
As with adults, there are no overall sample survey data available for children's obesity in Europe, based on measured height and weight. The International Obesity Task Force has provided figures based on national and regional survey data, published at the launch of the European Commission's Platform on Diet, Physical Activity and Health.[6] These are reproduced in Figures 2-3 and 2-4.

Figure 2-3. Estimated percentages of children aged 7-11 obese or overweight for selected European countries



Source: IOTF (http://www.iotf.org/database/index.asp)

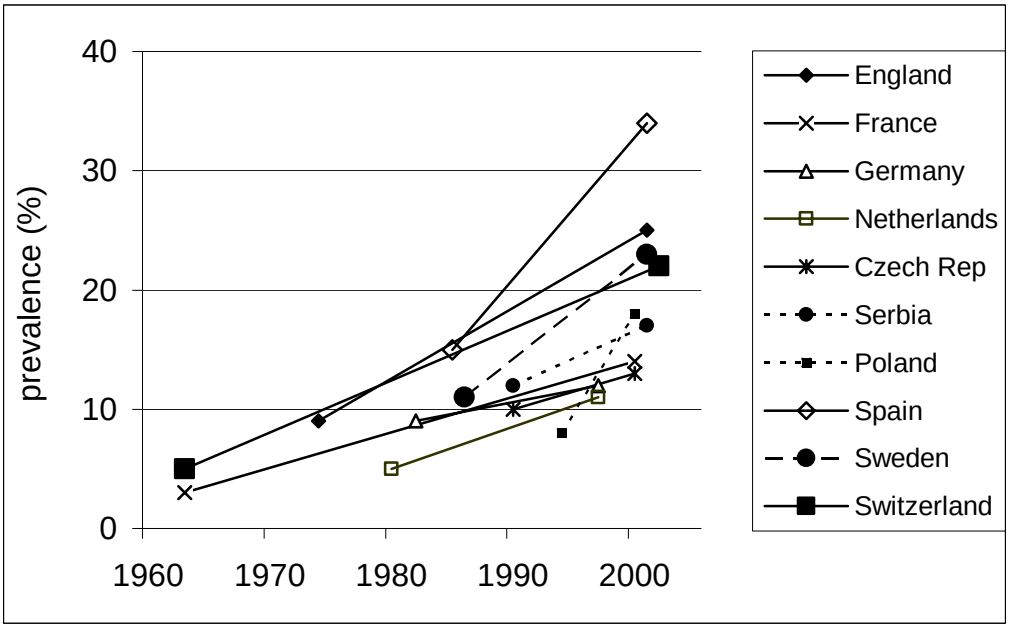
Figure 2-4. Estimated percentages of children aged 13-17 obese or overweight for selected European countries



Source: IOTF http://www.iotf.org/database/index.asp

Using historical survey data, countries in Europe have shown a rapid increase in the prevalence of childhood overweight and obesity.[7] Examples for selected countries are shown in Figure 2-5.

Figure 2-5. Trends in the prevalence of childhood overweight (including obesity) in selected European countries



Source: Jackson-Leach & Lobstein 2006[8] Note: Age groups may differ between countries

Estimates of childhood overweight and obesity in the European Union in 2006 and 2010 have been provided by Jackson-Leach and Lobstein[9] (table 2-2). The projections are based on trends from the 1980s and 1990s that indicate that the annual increase in child obesity prevalence is itself increasing. If these trends continue, by the year 2010 the European Union can expect to see the numbers of overweight and obese children rising by approximately 1.3 million children per year, of which the numbers of obese children will be rising by over 0.3 million per year.

Table 2-2. Proportion of children aged 5-17 years overweight and obese in the European Union (25 Member States) estimated for 2006 and projected to 2010.

	2006	2010
Overweight or obese	30.4%	36.7%
of which obese	7.1%	8.8%

Source: Jackson-Leach & Lobstein, 2006

2.4 Variations across population groups

This review is unable to analyse in depth and compare the differences between age groups or gender groups because of the lack of national data. However from the available data it appears that the prevalence levels for overweight and obesity increase through adulthood with the highest prevalence found among adults in their 50s and 60s. Members of age groups older than this may, according to the available data, show reduced overweight and

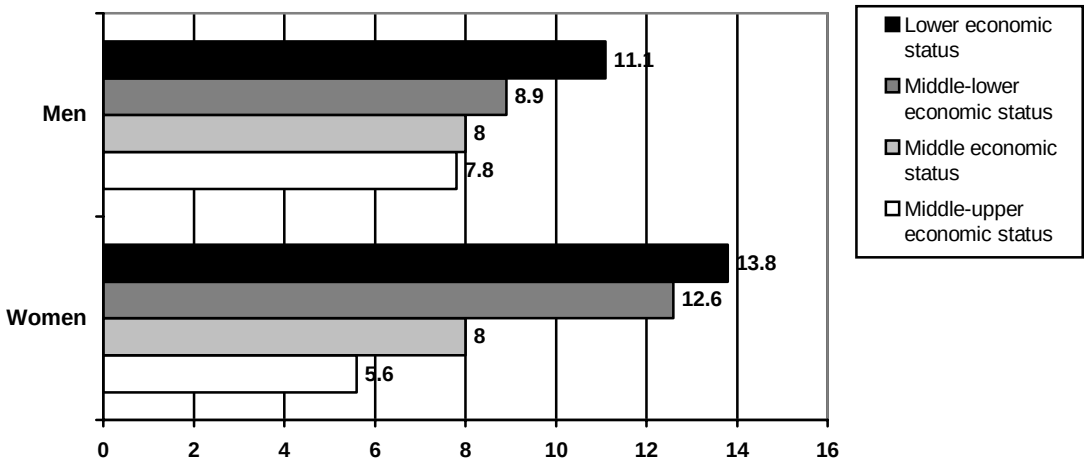
obesity prevalence levels due to (a) a healthier lifestyle during their younger years and/or (b) a selective attrition due to higher mortality rates from diseases linked to obesity.

Gender differences are not uniform across different age groups or groups differing by ethnicity, and patterns may appear paradoxical: for example in ten annual surveys in England 1993-2003 women have shown consistently higher levels of obesity (BMI>30) than men, but significantly lower levels of overweight (BMI 25-29.99) than men, in most age groups.[10]

2.4.1 Pan-European estimates of obesity prevalence by SES category

Two scientific reviews have attempted to summarise the differing levels of overweight or obesity among adults categorised according to indicators of socio-economic status. The first is that of Martinez et al, and the summary data are illustrated in Figure 2-6 below. One of the main drawbacks of the data is that it is based on self-reported measures of height and weight, which are known to underestimate true obesity prevalence levels by as much as 30%. Furthermore, this underestimation may be affected by socio-economic status so that the degree of inaccuracy may differ across the different elements shown in Figure 2-6.

Figure 2-6. Prevalence of obesity among adult men and women, by economic status, European Union



Source: adapted from Martinez et al., 1999 [11]
Economic status measured by household income or by occupation. Self-reported heights and weights

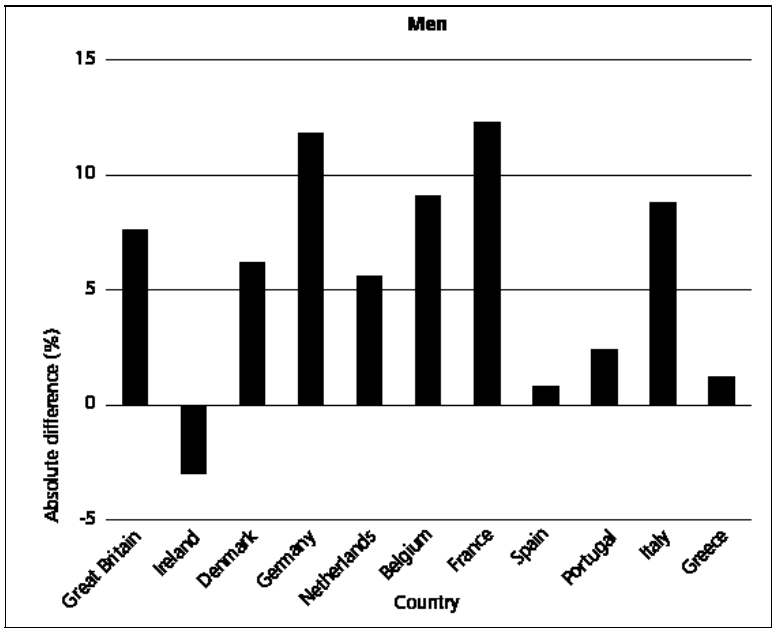
Despite these flaws in the data, the relationship between the elements is consistent enough to draw the conclusion that adults in lower income categories are experiencing higher levels of obesity than adults in high income groups, and the social gradient is likely to be a true effect across the total population. The information presented by Martinez et al suggests that, on the basis of surveys conducted in the 1990s and before, the social gradient can account for around 25% of the obesity prevalence in men and 50% in women.

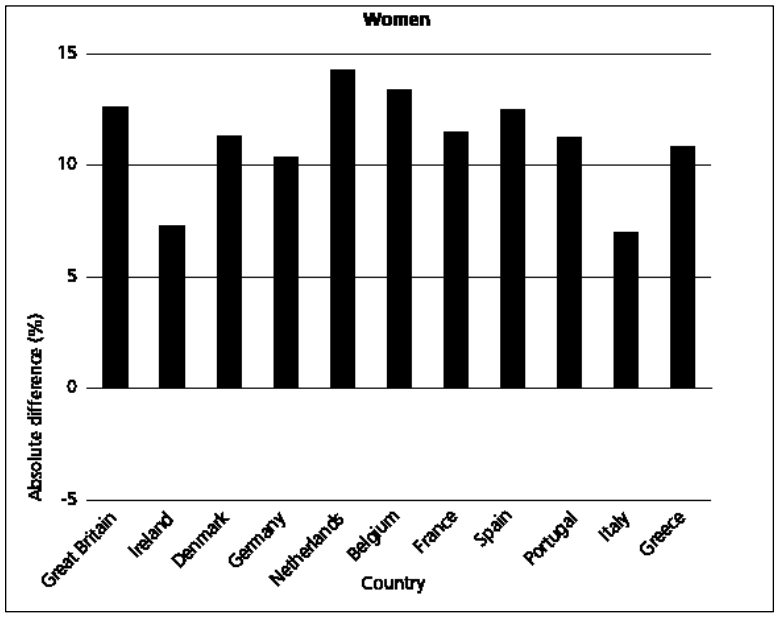
This is supported to a large extent by data collected from some 80,000 adults in the WHO MONICA project, with heights and weights professionally measured.[12] This collation of material covered 26 sites including 24 in the European region, and used years of education as an indicator of socio-economic status. It found that higher educational attainment was linked to lower BMIs in about half of the population groups with respect to men, and in

virtually all the groups with respect to women. The trends over a ten-year time period (in the 1980s and 1990s) suggested that the differentials were increasing, with *"a shift toward a stronger inverse association between educational level and BMI and larger differences in relative body weight by educational level"*. The authors expressed concern that socio-economic inequality in the health consequences of obesity were likely to increase in many countries.

Similar figures are reported by Cavelaars et al[13], in their analyses of the absolute difference in the prevalence of overweight among adults according to educational level, across eleven European countries (Figure 2-7): this also found more consistency in the effects of SES on excess bodyweight among women than men. In this analysis, based on a variety of surveys but all using self-reported measures of height and weight, the social gradient can account for differences in obesity prevalence of some 5 to 6 percentage points in men and 11 to 12 percentage points in women, echoing the analyses provided by Martinez (Figure 2-6). The wide variation in the differences for men should be noted.

Figure 2-7. Differences in obesity prevalence between highest and lowest socio-economic group, by country.

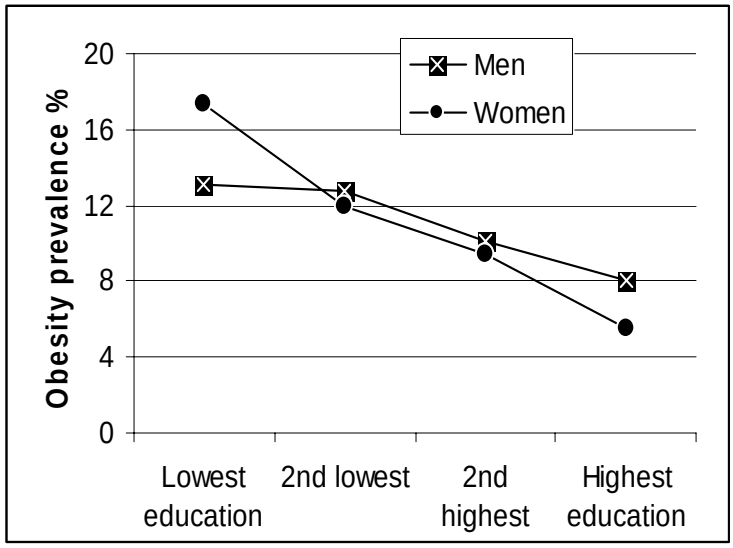




Source: Cavelaars et al 1997

The data used in the Cavelaars study has been updated and standardised for the Eurothine study, published in 2007.[14] This noted an overall SES gradient for both men and women based on 19 EU countries, with a stronger gradient for women than for men.

Figure 2-8. Obesity prevalence according to educational attainment, averaged across 19 EU Member States



Source: Eurothine 2007.

2.4.2 Ethnicity

There appears to be a tendency for members of certain minority ethnic groups to have higher levels of obesity, especially after several generations of residence in their host countries. These trends may in part be due to socio-economic differences, including greater exposure to environments conducive to weight gain, but may also reflect culturally-specific health-related behaviour patterns. Data available on ethnicity and obesity prevalence are referred to in the individual country reports below.

2.4.3 Country reports

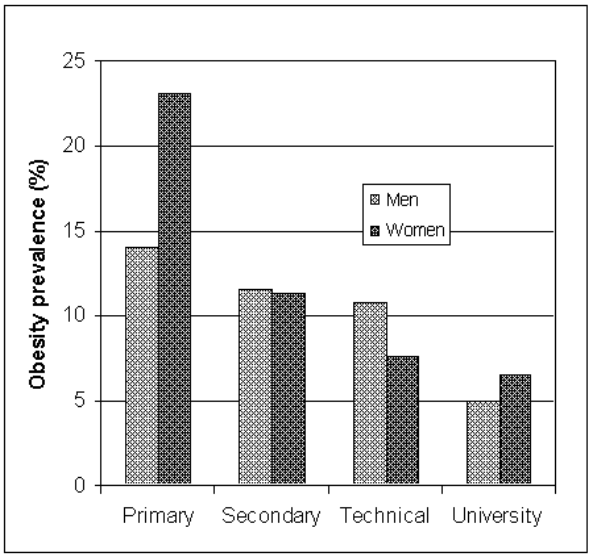
Data for a selection of 18 countries in the European region are presented below. The material is by no means exhaustive but is indicative of the main variations in obesity between different social groupings and trends over time. If the source material indicates that the data are based on measured or self-reported heights and weights, this is cited in the source references below.

Material is reported here for Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Malta, The Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden and the United Kingdom. It must be stressed that the source material varies considerably both in terms of the definitions used for SES (income, education, employment status, living standards, deprivation index) and for the indicators of excess weight (including whether self-reported or measured) and cannot be directly compared.

Belgium

Survey data collected in the early 1980s show a steep social gradient according to educational levels, and adjusted for age effects. Those with only primary level education were at least three times as likely to become obese as those with a university level education, and the gradient was steeper for women than for men.

Figure 2-9. Belgium: adult obesity prevalence by educational level

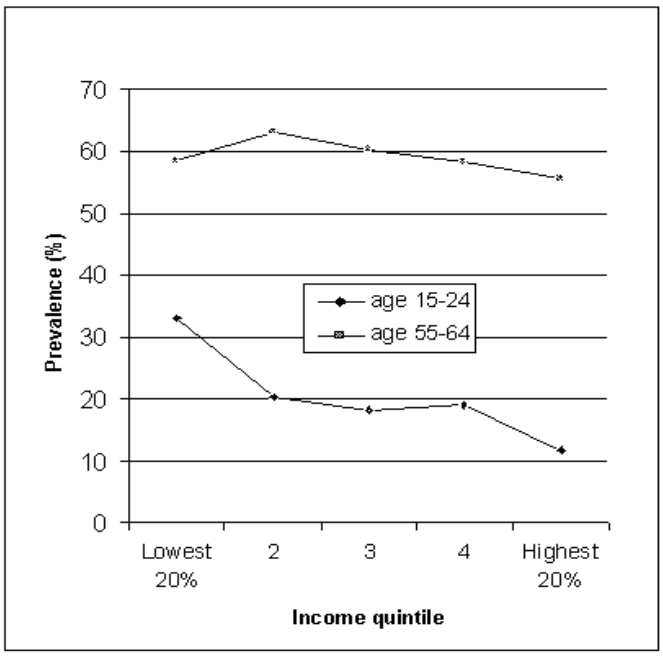


Measured data, adjusted for age differences.
Source: Adapted from Stam-Moraga et al 1999.[15]

In a more recent survey[16], educational levels were reported in categories of low, middle and high attainment: the low attainment category typically reported obesity prevalence levels 2.5 – 3 times those of the high attainment category, indicating that the socio-economic differentials remained just as large and possibly larger, given the smaller number of categories in the more recent survey. The same survey also gave information on obesity prevalence according to income levels: again a gradient was shown, with prevalence levels ranging from 8.5% for those in the top quintile of incomes, to 16.6% for those in the bottom quintile, and again the gradient was more marked for women than for men. It is also worth noting that the gradient appears to be more pronounced in younger

years, with a flattening of the SES gradient in later years (Figure 2-10). Unfortunately the database does not permit an analysis of age by SES for each gender separately.

Figure 2-10. Belgium: adult overweight prevalence by income quintile by age group



Self-reported data. Source: ISP 2004

Marriage appears to benefit men but increases obesity risk for women. The figure below shows obesity levels adjusted for age for four types of marital status. Singledom is best for women, even after adjusting for age. Widowhood is a time of high prevalence levels for obesity for both men and women: however, after adjusting for age, widowed men are slightly more at risk and women substantially less at risk of obesity than when married.

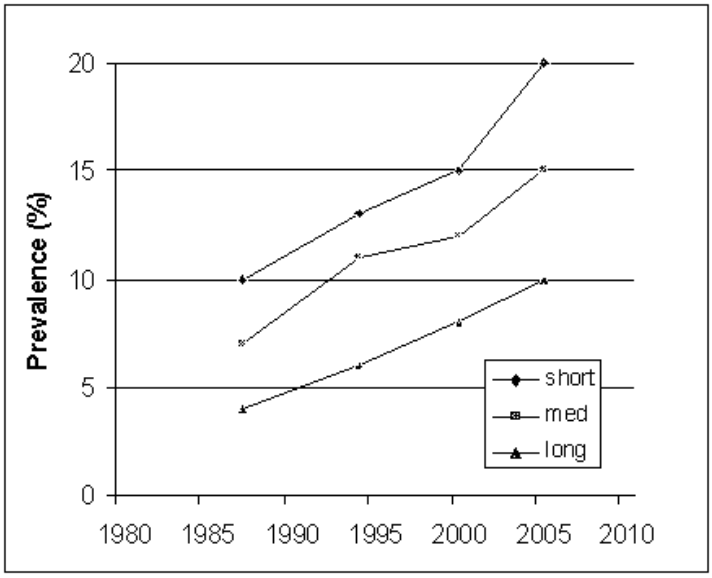
Figure 2-11. Belgium: adult obesity prevalence by marital status

Measured data. Source: Adapted from Stam-Moraga et al 1999.[17]
Data adjusted for age differences.

Denmark

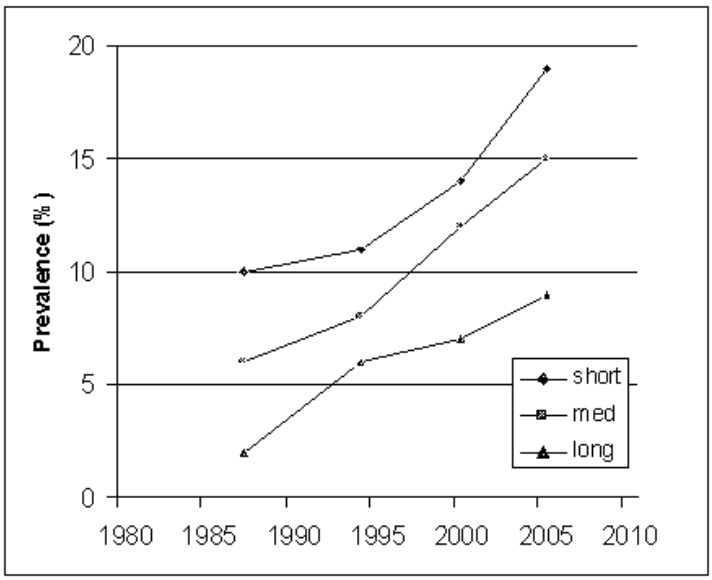
A dramatic increase in the prevalence of obesity among adults has been shown over the last two decades, affecting one in nine adults by 2005. There is a strong association between socio-economic status (measured in educational levels) and the prevalence of obesity. Those with least education have shown the most rapid rise over the period 1985-2005, and the gap between poorly educated and well-educated adults has widened, for both men and women, especially in the last decade.

Figure 2-12. Denmark: male adult obesity prevalence trends by years of education



Self-reported data. Source: Danish National Health Survey 2005[18]

Figure 2-13. Denmark: female adult obesity prevalence trends by years of education

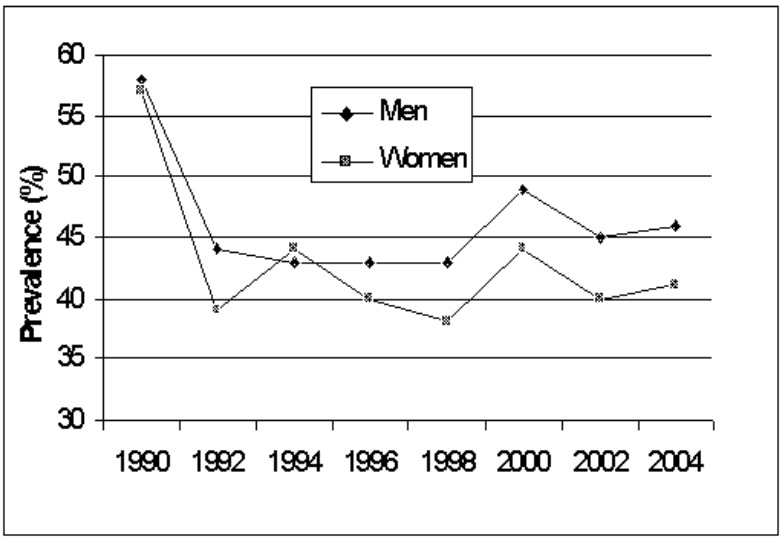


Self-reported data. Source: Danish National Health Survey 2005

Estonia

The Estonian population experienced a dramatic fall in the prevalence of overweight (including obesity) in the early 1990s, possibly reflecting the economic downturn experienced throughout much of Eastern Europe during the decade.

Figure 2-14. Estonia: adult obesity prevalence trends 1990-2004

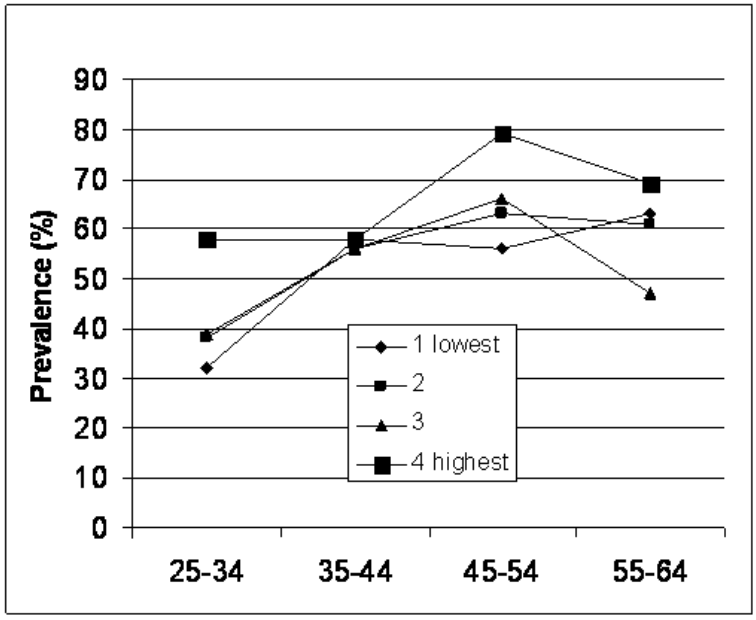


Self-reported data. Source: TAI, 2005[19]

The latest figures for overweight prevalence among different social groups allow an exploration of the differential effects of age and socio-economic status by gender. The results indicate an increase in overweight prevalence by age, and also a possible male reverse of the social gradient, with highest-paid men being the most overweight, but no significant gradient otherwise. The decline in prevalence in the older age group may reflect either a different life history for older men, or weight loss in the most obese through disease.

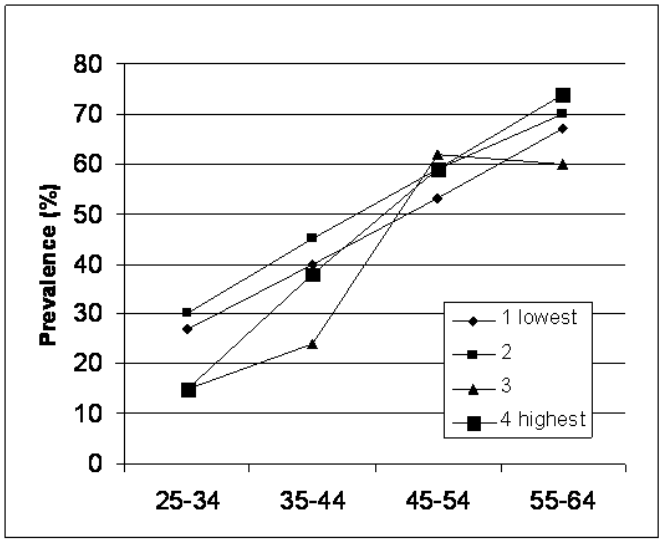
For women there appears to be a strong differential between higher and lower social groups for women in their child-bearing years with a narrowing of the gap in later years and no clear SES gradient in post-menopausal years. In the age group 25-34 the proportion of women overweight in lower income groups is double that in higher income groups, with important implications for intervention during the life cycle given the impact this will have on their reproductive health.

Figure 2-15. Estonia: male adult overweight (including obesity) prevalence by age group and income level in quartiles (1 lowest income to 4 highest income)



Self-reported data. Source: TAI, 2005

Figure 2-16. Estonia: female adult overweight (including obesity) prevalence by age group and income level in quartiles (1 lowest income to 4 highest income)

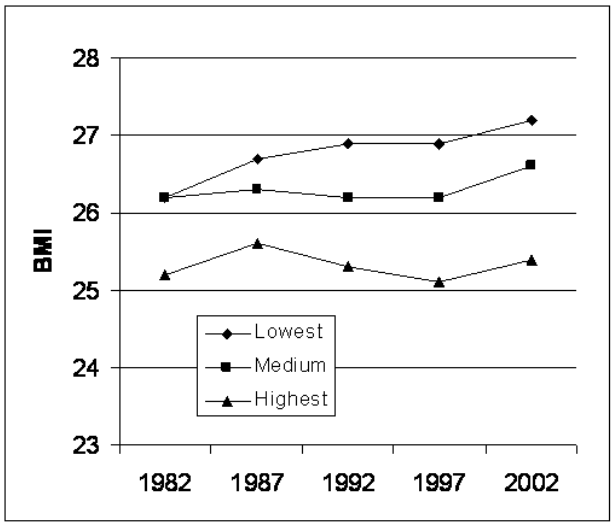


Self-reported data. Source: TAI, 2005

Finland

Studies in Finland indicate a significant increase in the prevalence of obesity in the last two decades for men, women and children. There are no clear differences in men's BMI between different socio-economic groups based on occupation or educational level, whereas differences are clearly shown for women, and trends over the last 20 years indicate a widening of the differences in the most recent period.

Figure 2-17. Finland: mean female BMI trends over time 1982-2002 by educational status (from lowest to highest)

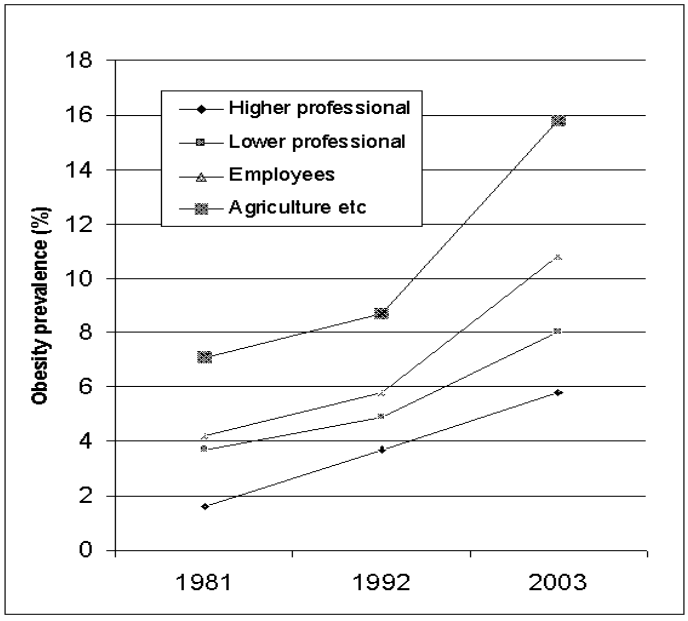


Measured data. Source: Lahti-Koski et al 2000[20], Borg and Fogelholm 2006[21]

France

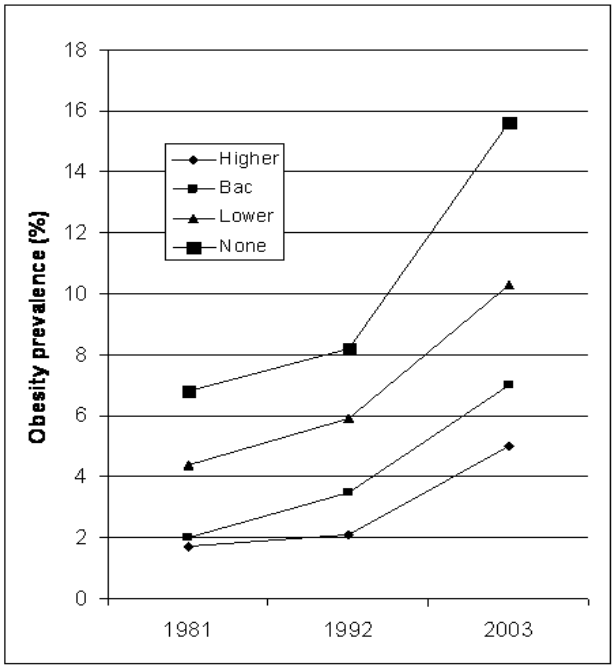
Although remaining a country with relatively low obesity prevalence in the European region, France has seen a significant increase in obesity levels in both adults and children in the last decade. Secular trends show a widening of the gap between higher and lower SES groups, equivalent to a steeper gradient across the groups.

Figure 2-18. France: adult obesity prevalence by occupation, trends 1981-2003



Self-reported data. Source: INSEE 2007[22]

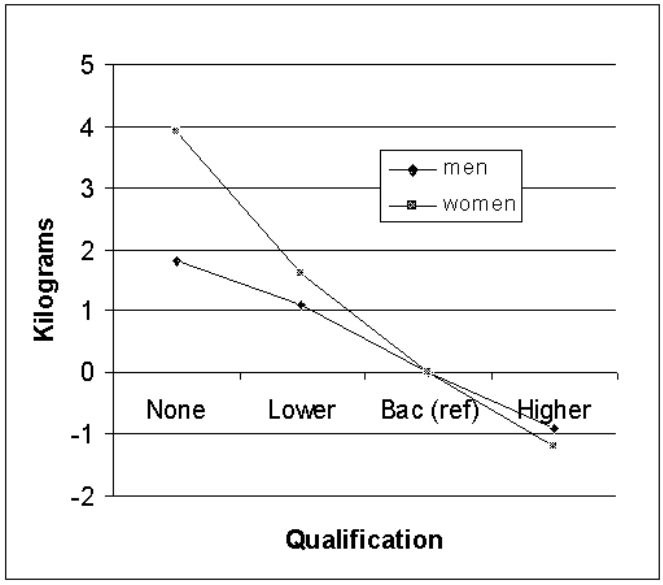
Figure 2-19. France: adult obesity prevalence by educational achievement, trends 1981-2003.



Self-reported data. Source: INSEE 2007

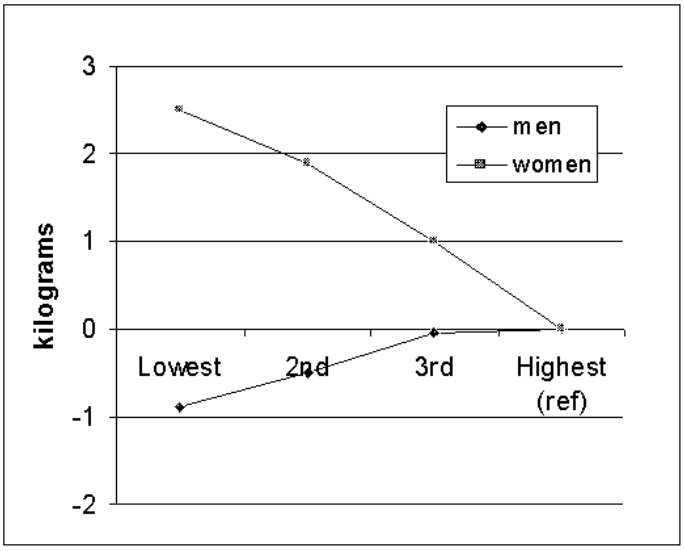
Gender differences may play a significant role in these social gradients. Data on the average difference in bodyweight between women of different social groups show a strong decline in average weight according to indicators of educational achievement and standard of living. For men, a shallower gradient is found in respect of educational achievement (Figure 2-20), and a tendency for the gradient to run in the other direction in respect of living standards (Figure 2-21).

Figure 2-20. France: average weight difference by level of educational qualification achieved, adult men and women.



Self-reported data. Source: INSEE 2007

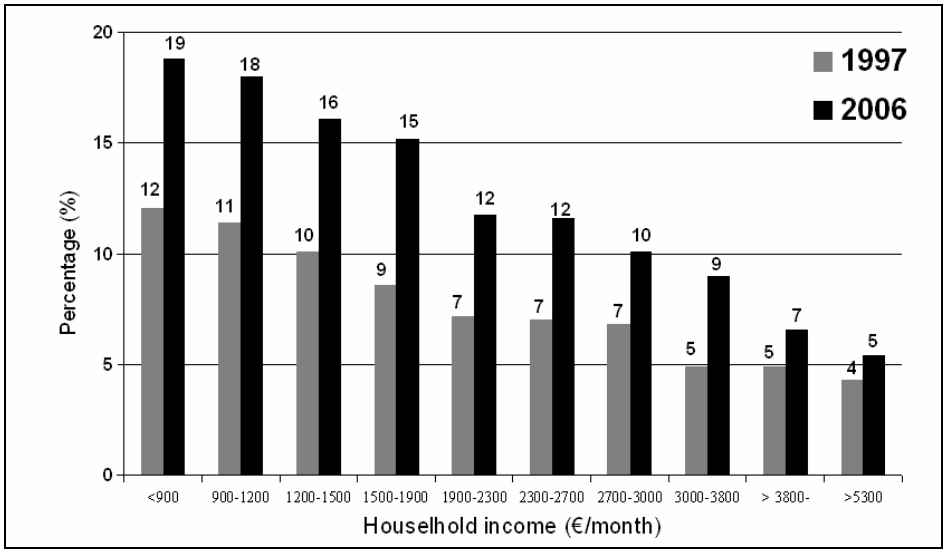
Figure 2-21. France: average weight difference by current living standards (quartiles), adult men and women



Self-reported data. Source: INSEE 2007

Recent data on household income and obesity levels (Figure 2-22) have been calculated by Darmon.[23] These show a clear and consistent social gradient which has become considerably steeper in the nine years 1997-2006.

Figure 2-22. France: obesity prevalence in adults by household income, 1997 & 2006.



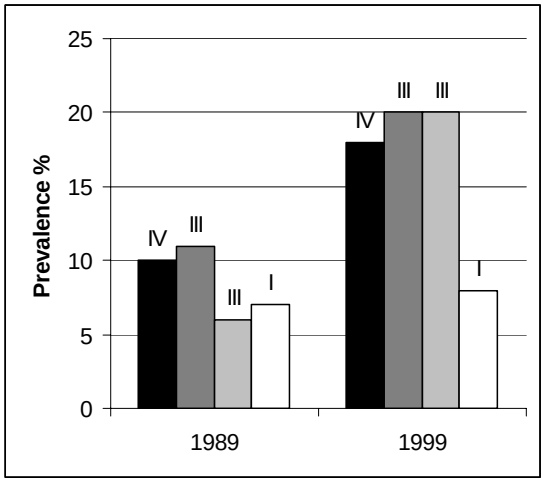
Self-reported data. Source: Obepi 1997 and Obepi 2006 (N Damon, personal communication).

Children in France have also shown a rise in obesity levels in recent years: a study in Lille found obesity prevalence rates had risen from below 2% in 1989 to nearly 5% a decade later among children of school entry age.[24] The prevalence of overweight and obese children combined increased from below 10% to nearly 17%.

The social gradient in obesity prevalence between children in households categorised by the professional status of the main income-earner increased dramatically over the period. As Figure 2-23 below shows, the prevalence of overweight and obesity (combined) for children aged five varies strongly according to their parental professional status, with

those in families with highest professional status showing markedly lower levels of overweight.

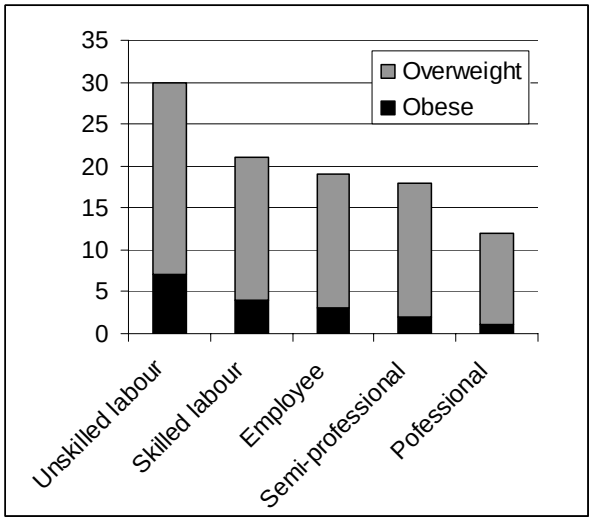
Figure 2-23. France: overweight prevalence among young children in 1989 and 1999, by parental professional class – IV (low) to I (high).



Measured data. Source Romon et al 2005

Of particular concern is the strong social gradient shown by adolescents in France, reported in a recent study, indicating that children in the families in the lowest social groups are carrying a potential disease burden into adulthood. As many co-morbidities of obesity are related to the length of time the individual has been obese as well as the severity of the obesity, this sharp social gradient among adolescents, with nearly a third of those in the lowest social grouping overweight, indicates a significant health burden during adulthood carried forward from their parental SES inequalities.

Figure 2-24. France: overweight and obesity prevalence among adolescents by parent's employment status



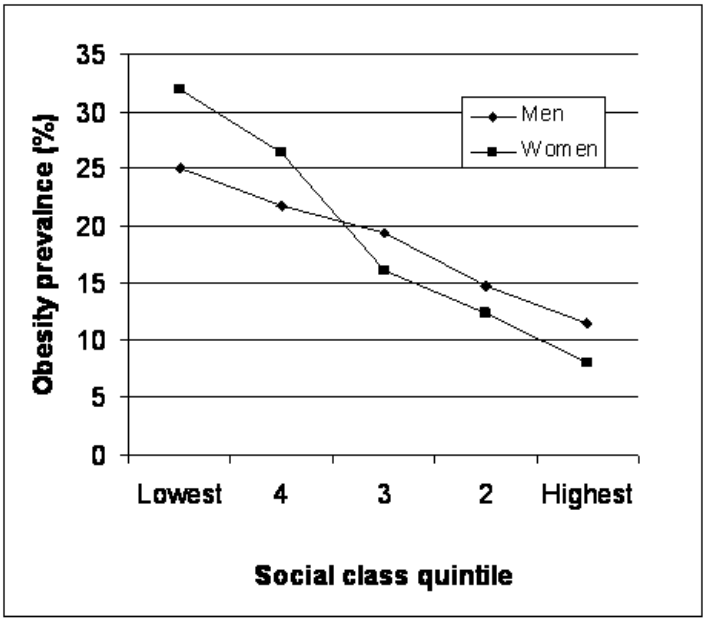
Measured data. Source: De Peretti et al 2004[25]

Germany

Historical data indicates mean BMI to be higher among those with lower SES (lower income and lower educational achievement groups) in both the western and eastern parts of Germany, with a gradient that is more pronounced for women than for men, and which has been apparent since the 1950s.[26] In a study in which social class index was defined

using a combination of employment, educational level and household income, a clear gradient in obesity prevalence is shown for both men and women. The data are for adults aged 25-69 years, adjusted for age differences across class group.

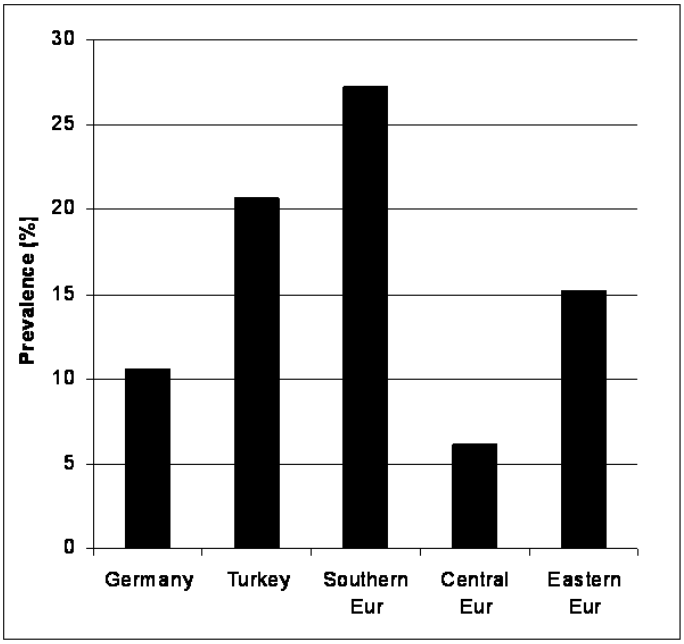
Figure 2-25. Germany: adult obesity prevalence by social class quintile



Measured data. Source: Helmert 2003[27]

A study of migrant children entering primary school found substantial difference in overweight prevalence according to their immigrant status. There are many reasons why this may be the case, include genetic and lifestyle differences. The researchers found that mothers' educational status explained much of the variation, and that a behavioural factor – a high level of use of television during the week – in combination with mothers' education accounted for virtually all the ethnic group differences.

Figure 2-26. Germany: overweight prevalence in children by country/area of origin



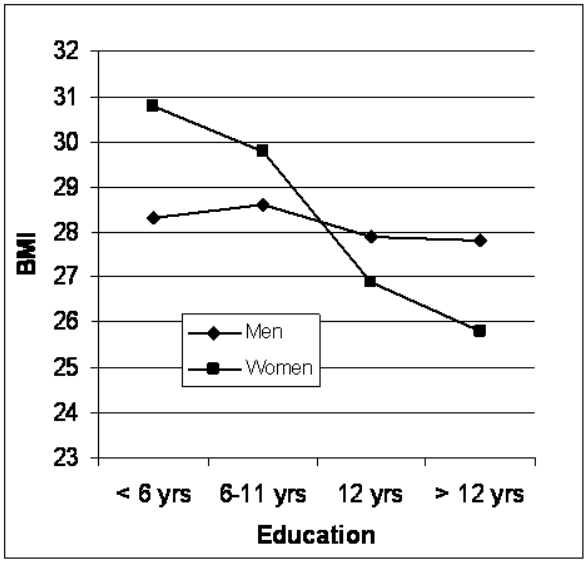
Measured data. Source: Kuepper-Nybelen et al 2005[28]

Greece

Measurements taken in the 1960s suggest adult obesity prevalence levels of below 5% and a further 20% overweight non-obese. Surveys in the 1990s have shown adult obesity prevalence rates of 15-20% and overweight non-obese 30-50%. In data collected in the late 1990s, obesity affected 30% of men aged 65-74, and an extraordinary 53% of women of this age range.[29]

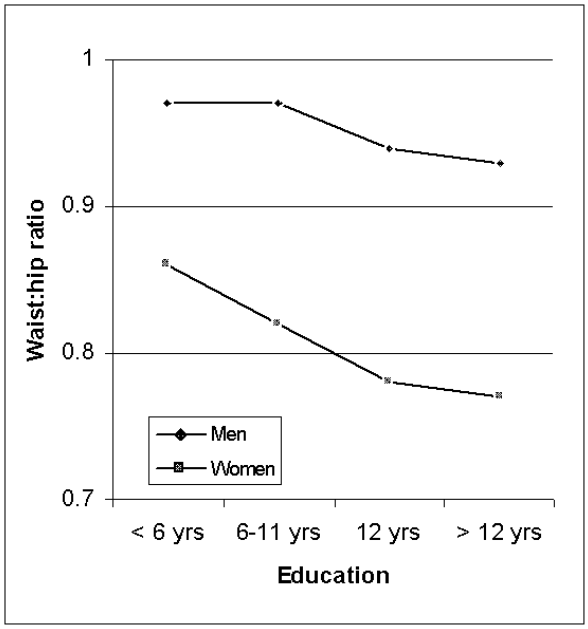
Data for mean BMI and mean waist-to-hip ratio are available for Greek adults participating in the EPIC (European Prospective Investigation into Cancer and Nutrition) study of middle-aged adults, showing a strong relationship with educational status, especially for women.

Figure 2-27. Greece: average BMI by years in education, adult men and women.



Measured data. Source: Trichopoulou et al 2005.[30]

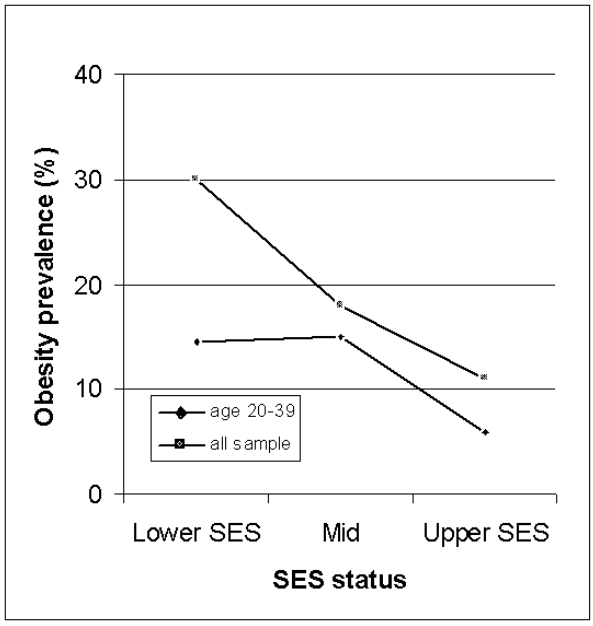
Figure 2-28. Greece: average waist:hip ratio by years in education, adults.



Measured data. Source: Trichopoulou et al 2005

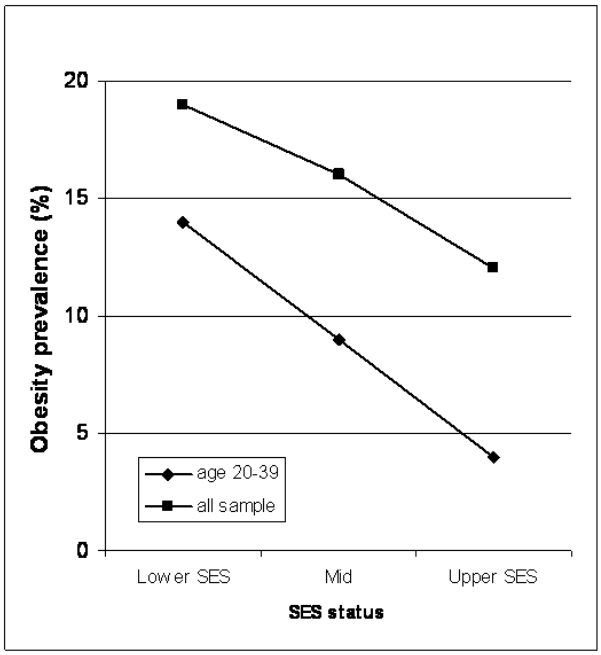
A study of over 300 adults in Attica found a strong relationship between obesity prevalence and socio-economic status, measured as a combined index of educational experience, occupation and income level, divided into three groups (tertiles). The results showed a strong gradient of obesity prevalence between SES tertiles. Figures 2-29 and 2-30 show the total for all adults (aged from 20 to over 70 years) and also the data for those of main reproductive years (aged 20-39). It can be seen that a steep social gradient exists overall for both genders, while for younger men the gradient is less well-defined, but for younger women it is particularly steep.

Figure 2-29. Greece: adult male obesity prevalence and SES.



Measured data. Source: Manios et al 2005[31]

Figure 2-30. Greece: adult female obesity prevalence and SES



Measured data. Source: Manios et al 2005

A study of aspects of the metabolic syndrome in a sample of over 4000 Greek adults found a higher mean level of abdominal obesity among the minority Greek Muslim community compared with the remaining population, after adjusting for age and gender differences.[32] However the Muslim community reported an average of nearly two years less education, and it is possible that socio-economic factors rather than some specific factor related to ethnicity may explain some of the difference in adiposity.

Hungary

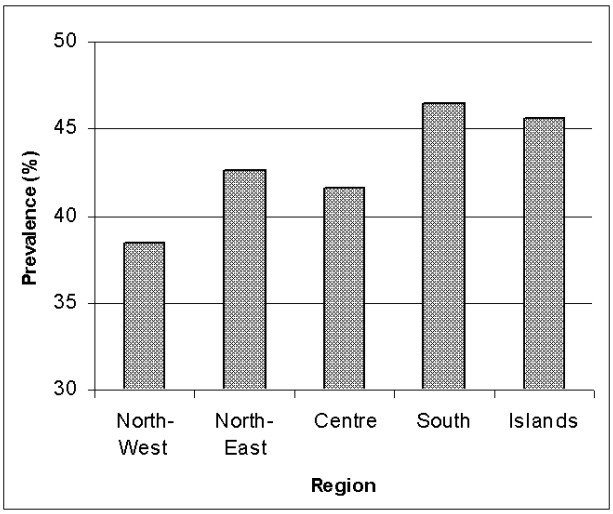
A national survey conducted in 2003 found some 53% of adults to be overweight, of which 19% were obese (data self-reported). Among people aged over 65 years the figure rose to 67% of which 28% were obese (Hungarian National Health Interview Survey (NHIS) 2003, cited in[33]). Of significance in the Hungarian data is the finding that among women aged 18-34 there was a significant problem with underweight, with one in nine women (11%) affected. There had been no improvement since a previous study in 2000, which also found underweight affecting 11% of this age group. This has implications for reproductive health that is discussed later. Only 1% of men were underweight in 2003, down from 2% in 2000.

The prevalence of overweight (including obesity) among primary school children was 17% in 2005, compared with 8% in 1980. Among older school children prevalence levels were 19% in 2005, up from 9% in 1980.[34]

Italy

Few data are available for social differences in Italy, but a strong regional divide between northern and southern Italy, closely reflecting regional economic differences, is apparent.

Figure 2-31. Italy: overweight prevalence among adults in five principle regions

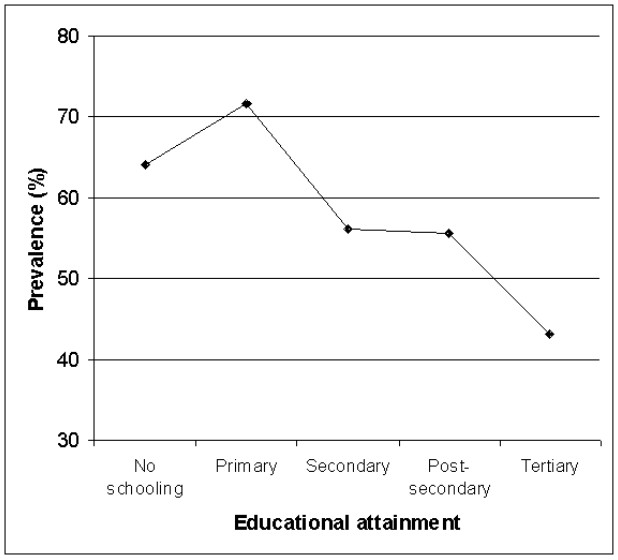


Self-reported data. Source: Italian national institute of statistics (ISTAT) 2005 [35]

Malta

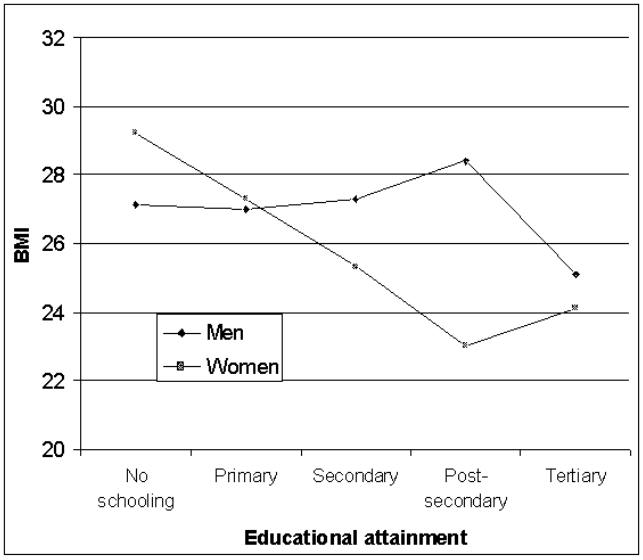
A national survey in 2003 found 60% of Maltese adults (aged over 18) to be overweight, including 20% obese, with the highest levels (77% overweight) among men aged 35-54.[36] As with several other countries, the data for Malta suggests that SES is a significant risk factor for higher BMI and obesity for women. Taking educational level as an indicator, data on the prevalence of overweight (including obesity) are available for all adults combined, and data for mean BMI are available for each gender, as shown below.

Figure 2-32. Malta: adult overweight prevalence by educational attainment.



Self-reported data. Source: NSO 2003[37]

Figure 2-33. Malta: average BMI by educational attainment, men and women



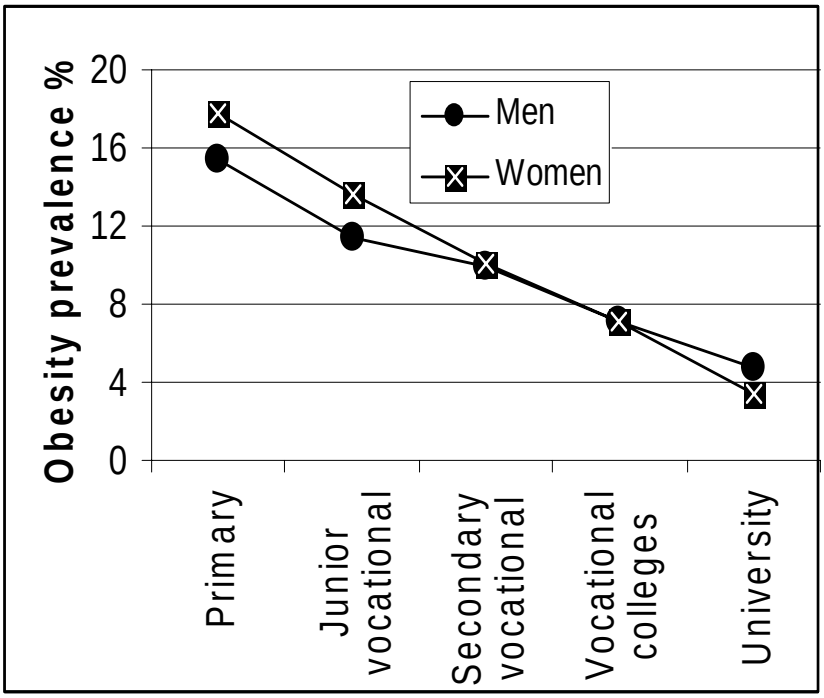
Self-reported data. Source: NSO 2003[38]

The Netherlands

The prevalence of overweight (including obesity) among Dutch adults rose from 43% to 48% in men and 31% to 34% in women in the period from around 1978 to 1995. Prevalence of obesity alone rose from 5% to over 8% in men and 6% to 9% in women over the same period.[39]

The more recent survey (conducted 1993-1997) indicated strong social gradients according to educational attainment. Age-adjusted average prevalence of obesity is shown for men and women in Figure 2-34.

Figure 2-34. The Netherlands: prevalence of obesity by educational attainment

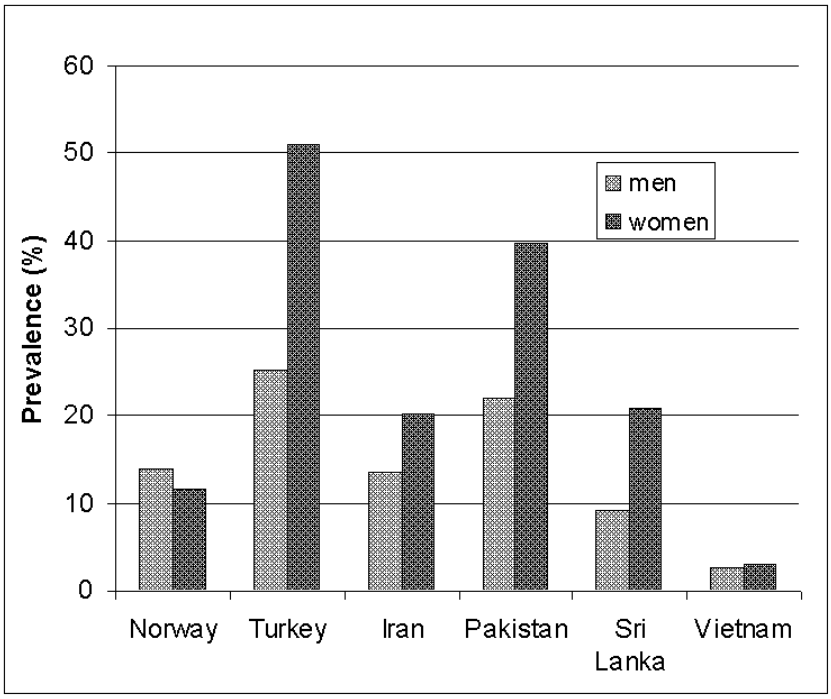


Measured data. Source: Visscher et al 2002.[40]

Norway

Obesity levels among Norwegian adults have increased in the 1990s, from around 9% to 13% in the period 1994-1998.[41] A study of immigrants in Oslo found widely contrasting levels of obesity, with some ethnic populations showing obesity levels several times that of Norwegians and others only a fraction of the Norwegian levels.

Figure 2-35. Norway: adult obesity prevalence among different ethnic groups

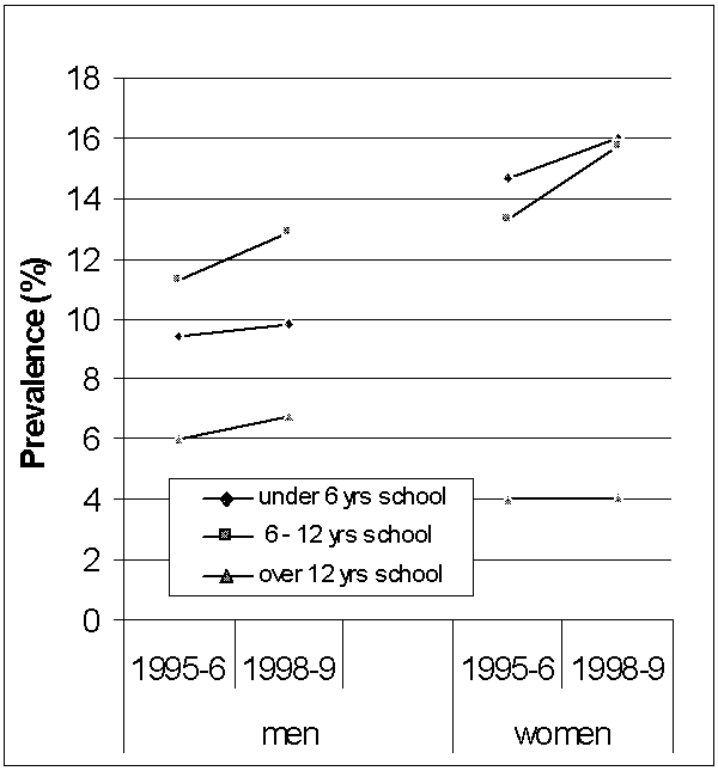


Source: Kumar et al 2006[42]

Portugal

National surveys conducted in the mid- and late-1990s show the steepest socio-economic gradients seen in any country in Europe. Using educational attainment as the indicator of SES, with male obesity in the lowest attainments groups was double that in the highest, and female obesity in the lowest group nearly four times that in the highest. Two surveys were taken three years apart, and in that time there was a noticeable increase in obesity prevalence in both men and women, and the differences between the educational attainment groups increased over time.

Figure 2-36. Portugal: adult obesity prevalence by years of school attendance, men and women, 1995-6 and 1998-9.



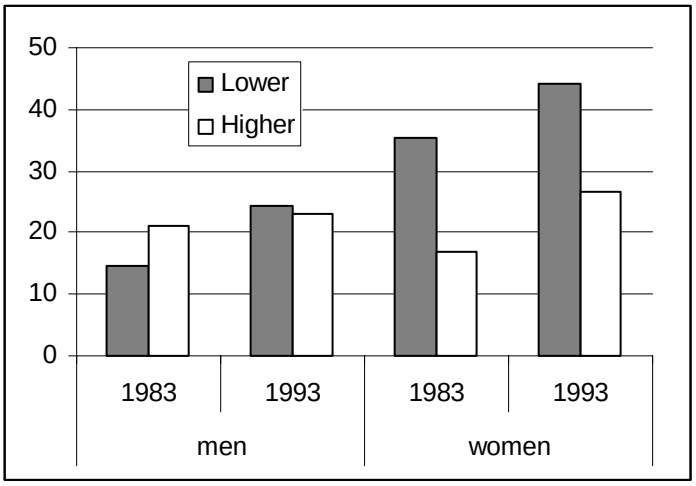
Self-reported data. Source: Marques-Vidal & Dias 2005[43]

Poland

Data for the year 2000 show overweight and obesity to be affecting large numbers of older Polish adults (70% of men and women aged 50-65 years), although fewer are affected in the younger age groups (32% of men and 14% of women aged under 30 years).[44] Notably, overall prevalence of overweight and obesity climbed very little in the period 1991-2000 (from 53% to 55% of all adult men, and 38% to 41% of all adult women), a period of depression and slow growth in the Polish economy.

During the previous decade, however, there had been a notable increase in obesity levels among Polish adults. The Monica survey showed obesity among rural men to rise from 12% to 21% and among rural women from 31% to 41% in the period 1983-1993.[45] Among urban men it rose 16% to 23% and among urban women from 26% to 3%. Furthermore, the figures are available for adults classified according to educational attainment (achieving *versus* not achieving high school graduation). The trends suggest that the pattern for men moved from one where better educated men were more likely to be obese to one where lesser educated men were more likely to be obese (Figure 2-37). Women of both educational groups showed a substantial rise in obesity prevalence, with those of lower educational attainment at much greater risk of obesity in both surveys.

Figure 2-37. Poland: adult obesity prevalence by educational attainment, 1983 and 1993.



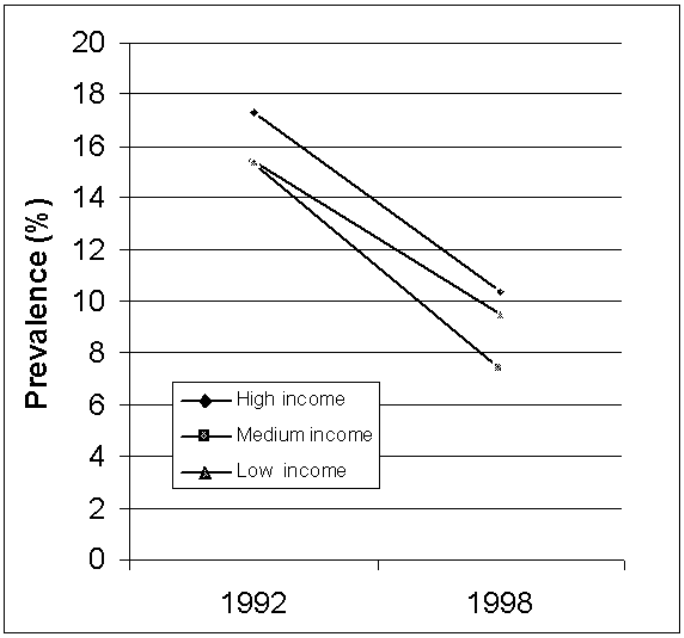
Measured data. Source: Dennis et al 2000
Lower = not achieved high school graduation; Higher = high school graduate.

By the year 2000, there were significant numbers of underweight women (11% of all women under age 30 with BMI<18.5, but only 2% of men).[46] The reasons for this are not clear. It is possible that young women are taking extreme measures to avoid weight gain (through dieting or smoking or excessive physical activity), perhaps in reaction to their overweight elder relatives. The consequences of underweight in young women are serious, not only for their own health but also for the health of their offspring.

Russia

The Russian Longitudinal Monitoring Survey undertaken nine times between 1992 and 2000 shows that during this period there was no increase in adult overweight prevalence, with a slight increase in obesity prevalence offset by a decline in the prevalence of non-obese overweight.[47] This is remarkable given the upward trends seen in most European countries, although possibly similar to the pattern seen among adults in Estonia and Poland (see above) and may be linked to the state of the economy and household food shortages and nutrient insecurity. Similar trends were shown among children, where overweight prevalence decreased (from 15.6% to 9.0%) and underweight increased (from 6.9% to 8.1%).[48] This decline affected adolescents and younger children, boys and girls, rural and urban populations, and children in the families of all three categories of socio-economic status (tertiles of per-capita income).

Figure 2-38. Russia: overweight prevalence among children by family income status, 1992 and 1998

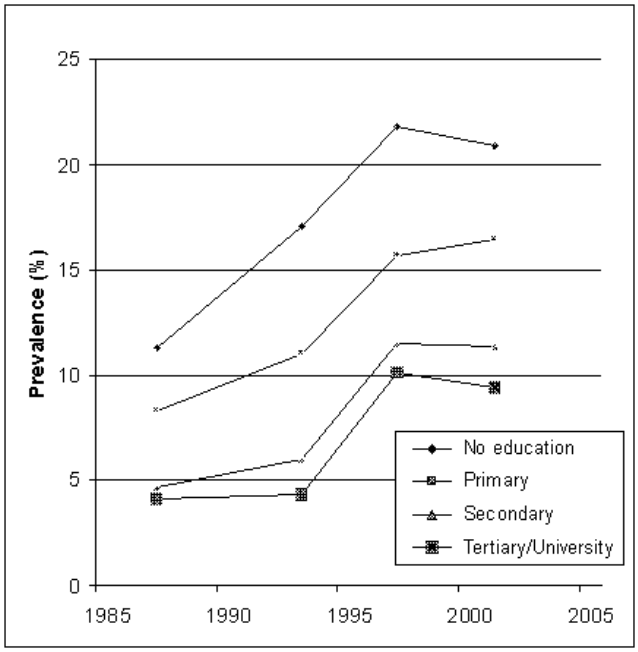


Measured data. Source: Wang et al 2002

Spain

A general rise in the prevalence of obesity has been noted among adults in Spain, and this is especially the case for those with lesser levels of education.

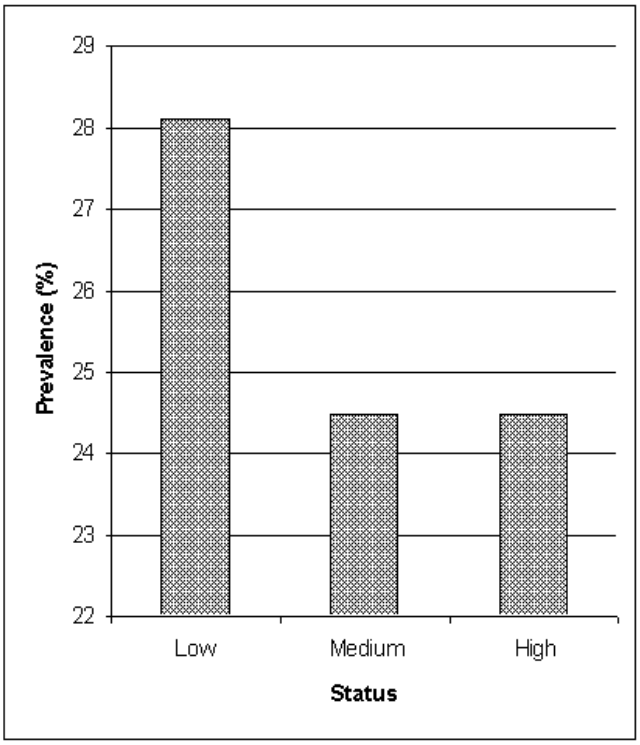
Figure 2-39. Spain: adult obesity prevalence by educational attainment, 1985 – 2005.



Self-reported data. Source: Gutierrez-Fisac et al 2002[49]

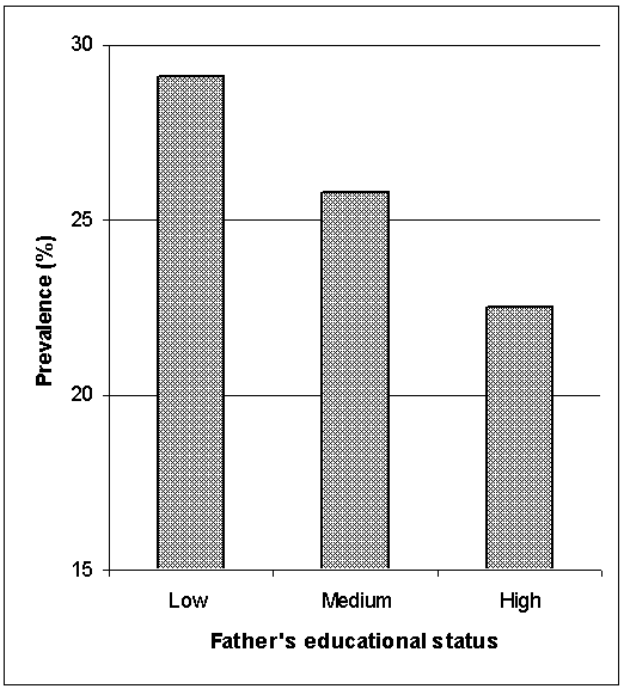
In a study of children and young people aged 2 to 24 years, the prevalence of overweight (defined as greater than the 85th centile of the Spanish national reference level) was strongly affected by family socio-economic status measured as a composite indicator and measured by educational attainment.[50]

Figure 2-40. Spain: overweight prevalence among children and young people, by family SES status



Measured data. Source: Serra-Majem et al 2003

Figure 2-41. Spain: overweight prevalence among children and young people, by father's education.

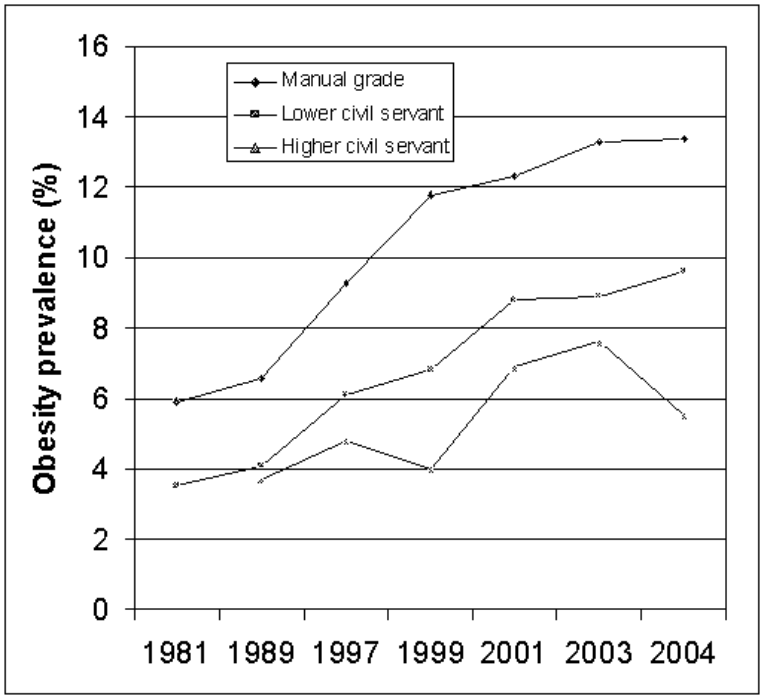


Measured data. Source: Serra-Majem et al 2003

Sweden

Obesity prevalence in both men and women in Sweden has risen from around 5% in 1980 to 10% in 2004.[51] Data for adults in different sectors of employment are shown (although not for each gender separately) and indicate a widening gap in obesity prevalence figures between higher SES and lower SES adults over the years 1980-2004.

Figure 2-42 Sweden: adult obesity prevalence by employment status, 1980/81-2004



Self-reported data. Source: Statistiska Centralbyrån (SCB) 2007

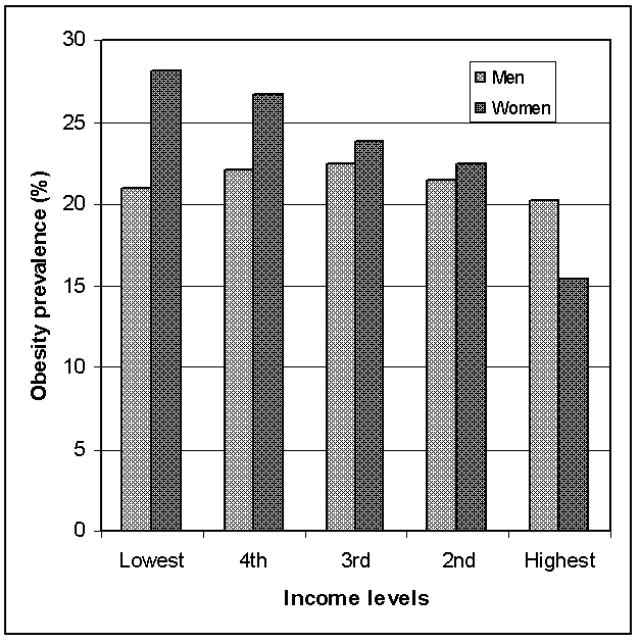
United Kingdom

Separate surveys have been undertaken for the different parts of the United Kingdom, with the most long-running series of surveys (the Health Survey for England) taking measured heights and weights of adults, and more recently children for over two decades.[52]

Recent figures for England indicate that nearly 58% of all adult women, and 66% of all adult men are overweight, including over 20% obese (both genders). Only in the age group 16-34 is the overweight prevalence level below 50%. Similar figures have been found in Scotland, with over 50% of all adult women and over 60% of all adult men overweight (including over 20% obese for both genders).[53] [54] A summary of the results of the Welsh Health Survey 2003-2004 indicated that 54% of Welsh adults were overweight or obese, of which 17% were obese, but these data were based on self-reported heights and weights.[55]

In England, obesity prevalence among women show significant SES gradient from 16% in the highest fifth of households according to income, up to 28% in the lowest fifth of households according to income (Figure 2-43). Men's obesity prevalence shows no simple relation to household income level.

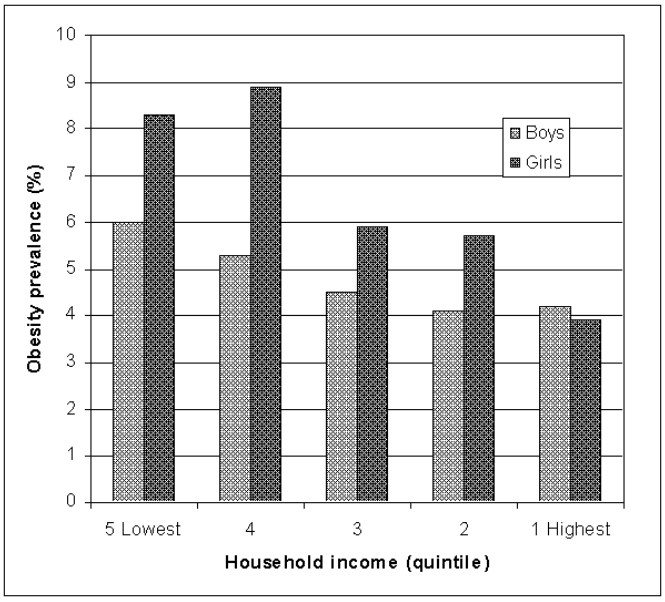
Figure 2-43: England: adult obesity prevalence by household income (quintiles)



Measured data. Source: Health Survey for England 2003[56]

For children, a similar pattern to that shown for women is apparent. Girls in families in the lowest quintiles of income level have obesity prevalence levels of 8 to 9% compared to less than 4% among girls in the highest quintile. Boys show a similar though less steep gradient. In Scotland, the same findings were found for girls (low household income was associated with higher obesity prevalence) but not for boys.[57]

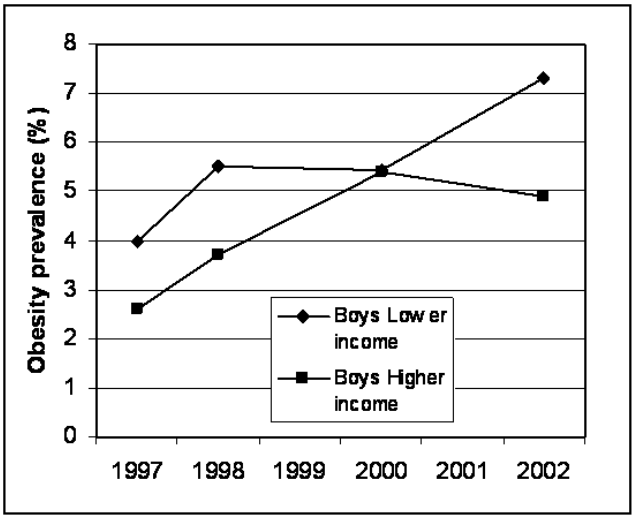
Figure 2-44: England: child obesity prevalence by household income (quintiles)

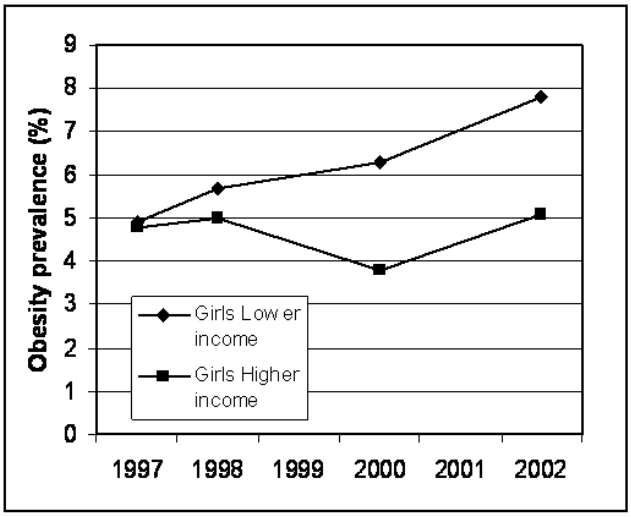


Measured data. Source: Health Survey for England 2003[58]

Secular trends from the Health Survey for England compiled by Stamatakis[59] suggests that childhood obesity increased rapidly in the five years 1997-2002 and that this increase was more marked among children from low income families. The increased SES gradient for girls is particularly notable.

Figure 2-45 England: child obesity trends by family income, boys (above) and girls.

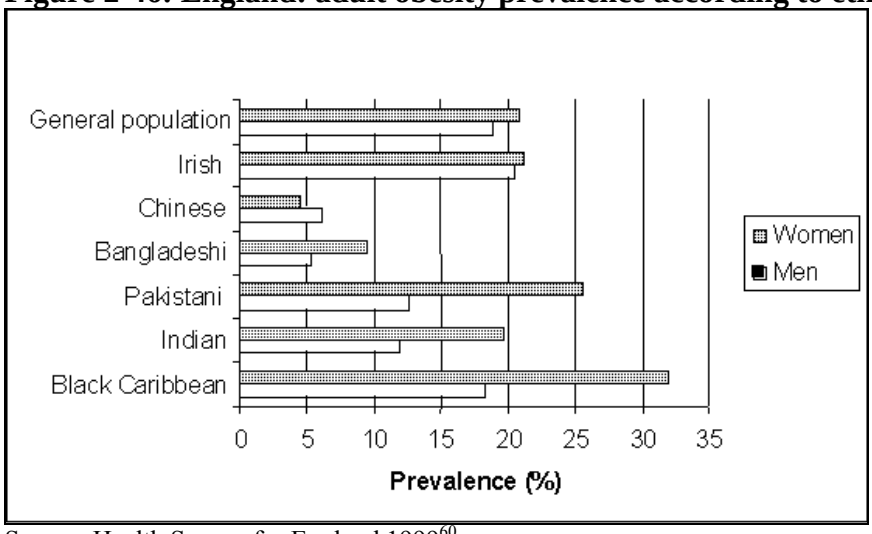




Measured data. Source: Stamatakis 2005.

Data showing obesity prevalence according to ethnic group are available for England and indicate significant differences: for example 30% of black Caribbean women are classified obese, compared with fewer than 10% of Chinese women (Figure 2-46):

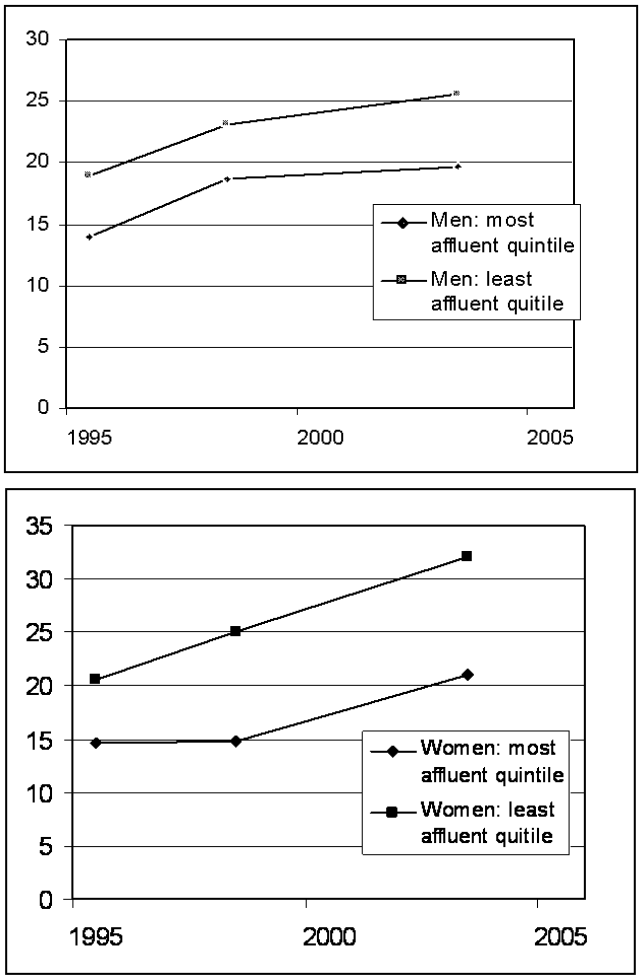
Figure 2-46: England: adult obesity prevalence according to ethnic group



Source: Health Survey for England 1999[60]

Surveys in Scotland show a similar pattern, with men and women in the most affluent quintiles (using the Scottish Index of Multiple Deprivation[61]) having lower obesity prevalence than those in the lowest quintile. Comparisons with previous Scottish surveys show an increase in the social class differentials over the period of the three health surveys.

Figure 2-47: Scotland: adult obesity prevalence according to highest and lowest quintile of income, 1995-2003, men (above) and women.



Self-reported data. Source: Scottish Health Surveys 1995, 1998, 2003.[62]

2.4.4 Average income and distribution of income

In this section we consider cross-country analyses of data on socio-economic conditions, comparing obesity levels in different countries with their average national income levels and with the indicators of the distribution of national wealth.

Taking GDP per capita in a range of European countries (including the states of the former Soviet Union) there is a tendency for obesity prevalence to be higher in countries with higher per capita GDP, although at levels above around $10,000 this relationship breaks down and prevalence levels tend to be lower with greater GDP. A similar pattern is shown for overweight, non-obese adults, with higher per capita GDP associated with increasing prevalence of overweight to around the $10,000 level, after which there is no obvious

trend (Figures 2-48 and 2-49 show data for 38 countries of the WHO European Region for which figures were available).

This relationship is similar to that reported by Ezzati et al (2005)[63] who compared mean BMI for adults with average income levels for 100 countries and found rising BMI with rising income, with a peak in BMI occurring at around $12-15,000 for women and around $15-17,000 for men, above which a slight decline was found.

Figure 2-48. Obesity prevalence in adults by national GDP, WHO European region

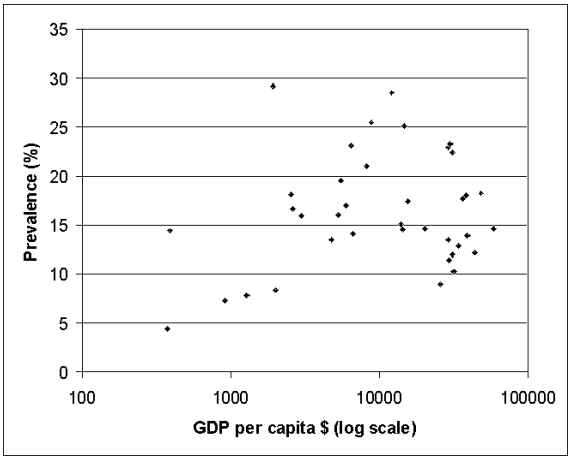
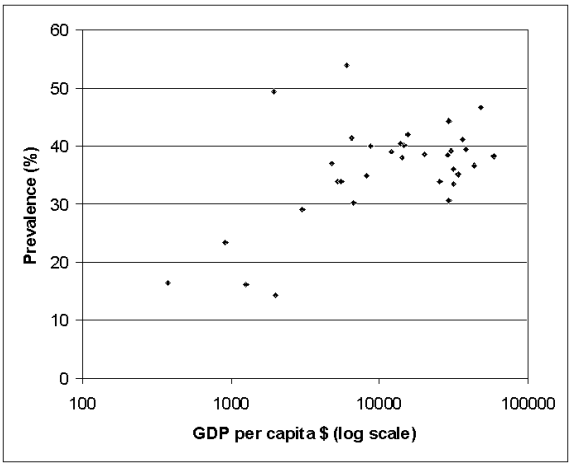


Figure 2-49. Overweight (non-obese) in adults by GDP, WHO European region

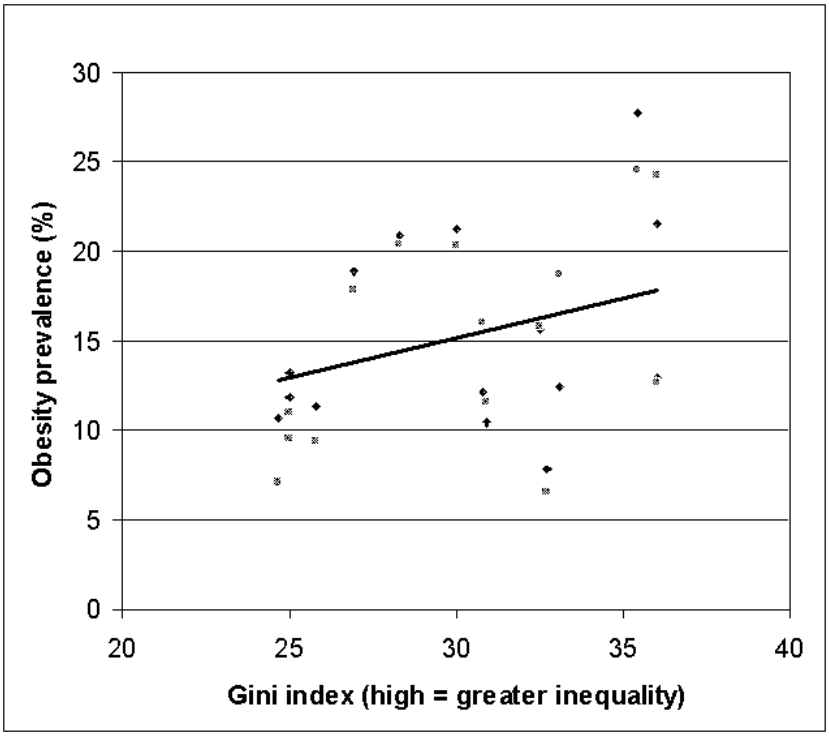


Sources IOTF (overweight and obesity), UNDP (per capita GDP)

Most of the countries of central and Western Europe have per capita GDPs above the $10,000 level. In a study of wealthier countries (OECD members), Pickett et al show that adult obesity levels are associated with the relative *distribution* of wealth within each country.[64] One of the principle health co-morbidities of obesity, type 2 diabetes, was also closely linked to the relative distribution of wealth. The links between inequality indices and obesity bear further examination and the figures have been re-worked for the present paper.

Taking the wealthiest countries of Europe, and using the Gini index, which measures inequality in income distribution, there is a tendency for obesity to be greater in countries with a greater inequality in wealth distribution (Figure 2-50 - the correlation is statistically significant for women, though not for men).

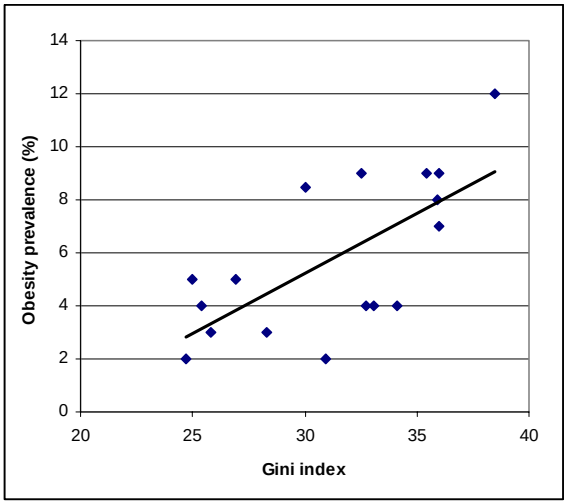
Figure 2-50. Relationships between measures of national wealth inequality (Gini index) and prevalence of obesity in adult males and females



Males (diamonds) r=0.33, ns
Females (squares) r=0.52, p<0.05 (trendline shown)
Source: IOTF and WHO The European Health Report 2005[65]

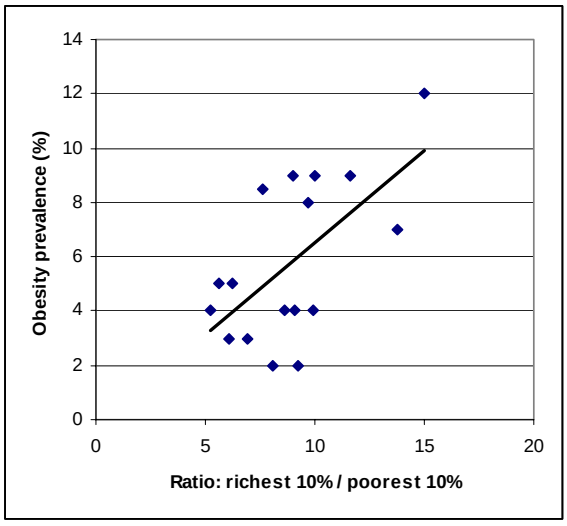
However, the prevalence of obesity in adults is largely a measure of accumulated adiposity over a long period, including times when inequalities and their health effects may have been very different to those experienced latterly. For this reason, it is important to consider making comparisons between inequalities and obesity levels in relatively young populations. Reliable data for child obesity levels are available for 18 high income European countries for which wealth distribution indices are also available. Taking the data for obesity prevalence among children of primary school age (7-11 years), there is a strong and clear indication that unequal wealth distribution is closely associated with the prevalence of obesity, using several different measures of inequality: the Gini index, the ratio of incomes between those above the 90th centile and those below the 10th centile, and the proportion of children in the population living in relative poverty (households with income less than half the national median level).

Figure 2-51. Obesity prevalence in children aged 7-11 years by national Gini index.



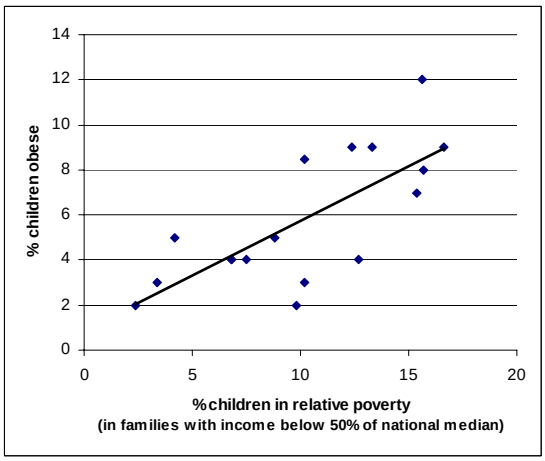
Correlation r=0.69, p<0.01
Source: IOTF and The European Health Report 2005

Figure 2-52. Obesity prevalence in children years by national 90:10 income ratio.



Correlation r=0.62, p<0.01
Source: IOTF and The European Health Report 2005.

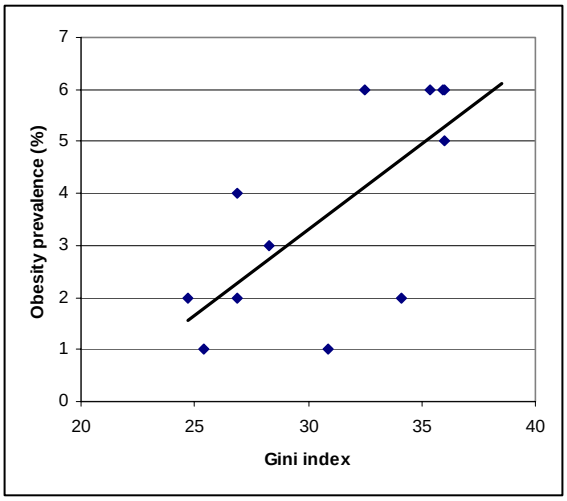
Figure 2-53. Obesity prevalence in children by national relative poverty index.



Correlation r=0.74, p<0.001
Source: IOTF and The European Health Report 2005.

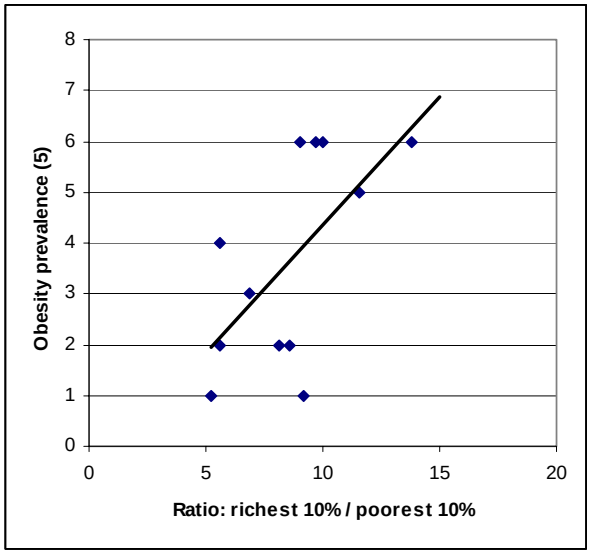
Equally close associations between wealth distribution indicators and obesity are found with older children. Reliable data for adolescent obesity levels are available for 14 high income European countries for which wealth distribution indices are also available. The data indicates that obesity prevalence among adolescents (age 12-17) is closely linked to all three national indices of economic inequality.

Figure 2-54. Adolescent obesity prevalence years by national Gini index.



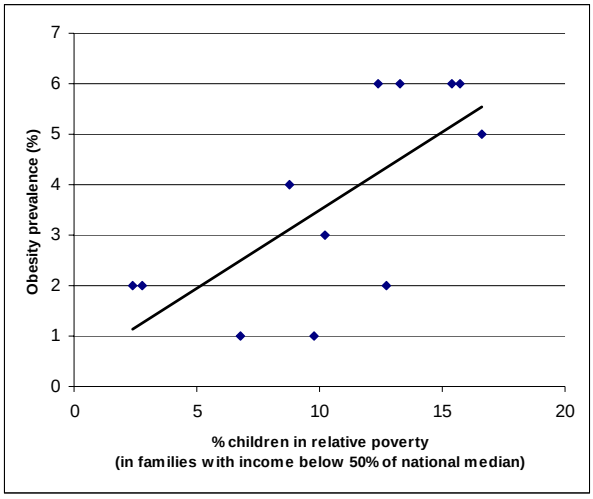
Correlation r=0.71, p<0.01
Source: IOTF and The European Health Report 2005.

Figure 2-55. Prevalence of obesity in adolescents aged 12-17 years by national 90:10 income ratio.



Correlation r=0.62, p<0.05
Source: IOTF and The European Health Report 2005.

Figure 2-56. Prevalence of obesity in adolescents aged 12-17 years by national relative poverty index.



Correlation r=0.72, p<0.01
Source: IOTF and The European Health Report 2005.

The figures presented above must be treated cautiously. They do not prove causation, but indicate an association between indices of national wealth and indices of population body weight. Detailed modelling of these relationships how they change across time is needed in order to understand more clearly how population wealth and relative inequality may be affecting the prevalence of obesity.

If causal links exist then they are clearly of great importance. It is possible that greater inequalities within a society lead those in the poorer income categories to experience lower self-esteem, and this in turn influences their health behaviour, including physical activity and dietary choices for themselves and their families.[66]

Equally, obesity prevention (and obesity treatment) may be less successful among lower-income groups than amongst those with higher incomes.[67] In so far as there are obesity prevention interventions in place, these may well be influencing social categories differentially, and in those populations with the greatest disparities there may be larger numbers who are failing to be reached by these interventions.

These possibilities raise important issues on the efficacy of obesity prevention interventions and the need to ensure access to health-enhancing environments for all sections of society is discussed later.

2.5 Overview of SES gradients in obesity prevalence

There has been a marked increase in overweight and obesity in most of the countries of the European region, with the exceptions being found in Eastern regions during severe economic recessions. Otherwise the rise in obesity has affected virtually all population groups, but has generally been more severe for those in lower income and lower education groups, and some minority ethnic groups. Where data are available, the gradient in obesity and overweight prevalence between excess bodyweight across the various measures of socio-economic status is clear and is steeper among women and children than it is among men in most countries. Exceptions appear to be found in some Eastern European countries, where obesity may be more common in higher SEGs, possibly due to high levels of physical activity or high prevalence of tobacco smoking among lower SEGs.

Across much of Europe, the social gradient in obesity appears to be greater among girls and younger women than older women.

It must be noted that the evidence base is poor. Data are not comparable between countries: not only are the socio-economic indicators different in many cases, but also the obesity prevalence data may be based on different age ranges, may or may not be adjusted for age disparities, and, more seriously, may be based on self-reported rather than objectively measured heights and weights.

The material published by Martinez et al, the MONICA project, Cavelaars et al and Eurothine synthesize data across countries in a comparable form. These analyses, comparing the highest and lowest SES categories, show an absolute difference of some 3 to 5 percentage points for males compared with some 8 to 10 percentage points for females, accounting for about one quarter (25%) and one half (50%) of the total obesity prevalence, respectively.

Using the data examined for this report (table 2-3) gives an indication of the impact on obesity prevalence that is attributable to being below the highest socio-economic group (attributable risk due to inequality, calculated as the difference between the population average obesity prevalence level and the prevalence level found among the highest socio-economic group, as a proportion of the population average). An unweighted estimate from these figures indicates that 26% of obesity in men and over 44% of obesity in women is attributable to SES differences.

Table 2-3 Relative importance of inequality in overall obesity prevalence

See text above for explanation

Country (SES indicator)	Adults	
	Men	Women
Belgium (education)	60%	73%
Denmark (education)	15%	18%
Estonia* (income) age 25-34	-46%	39%
age 25-44	-21%	18%
Finland (education)	12%	25%
France (household income)	59%	
Germany (SES index)	47%	66%
Greece (SES) age 20-39	50%	56%
Malta (education)	61%	
Netherlands (education)	45%	63%
Poland (education)	3%	25%
Portugal (education)	41%	71%
Sweden (education)	39%	39%
UK England (income)	9%	33%
UK Scotland (deprivation index)	11%	13%
Unweighted average	***26%***	***44%***
European Union 1997 (from Martinez et al[68])	*13%*	*45%*
European Union 1999-2004 (from Eurothine[69])	*26%*	*50%*

* Data for Estonia are for overweight (BMI >25)

In the table a figure of 0% indicates that inequalities account for none of the obesity prevalence, a figure of 100% indicates that inequalities account for all of the obesity prevalence, while a negative figure (e.g. men in Estonia) indicates that higher SEGs have a higher prevalence of obesity than the average.

Expressed as a proportion of the prevalence found in the total population, the figures indicate the importance of inequality as a contributor to the obesity epidemic. The estimates refer to the most recent information but are not strictly comparable between countries and should be considered indicative only. Comparisons between countries should not be made because

of: different SES indicators; self-reported versus measured data; and data may not be nationally representative. It is recommended that a standardised analysis is carried out on a European-wide basis e.g. within the DG SANCO funded DYNAMO-HIA project.

Differential obesity risk according to indices of wealth at personal level are matched by risk of high obesity prevalence for a country according to its absolute level of wealth and the degree of inequality in wealth distribution. For countries with national average incomes above around $10,000 per capita, the distribution of wealth appears to be a predictor of obesity prevalence, especially among children and adolescents (possibly because obesity in older adults is affected by historical factors as well as current national wealth levels).The relationship between health and inequalities at cross-national level would predict a consistent and fairly linear relationship to be found between socio-economic status and obesity at individual level, and as noted above, this is reasonably well demonstrated for women, and to some extent for children, but less clearly shown for men. Inequalities across the European region may have significant implications. In England (Gini Index = 36) the prevalence of obesity among adults was around 22% in 2004, while in Sweden (Gini Index = 25) the rates were 10% in that year. There could be a possible fall in obesity levels in the UK if income distribution matched that of Sweden, assuming the association between obesity prevalence and income distribution is causally linked.

Furthermore, if the inequality levelled everyone upwards rather than downwards – for example, if all of England's population had household incomes similar to that enjoyed by higher income earners – obesity levels might be even more dramatically reduced. The effects might be expected to be more pronounced for women and children than for men, with obesity levels potentially falling to less than half of their present levels in countries such as England. These are purely speculative figures, but they serve to emphasise the need for more detailed modelling of potential scenarios. In so far as models are only as good as the data put into them, it also serves to emphasise the need for more robust surveillance data, sampled across Europe, on a regular basis, using a standardised approach to the measurement of height and weight and of socio-economic status.

The greater sensitivity of women and children to socio-economic effects on obesity risk leads to a number of issues that should be addressed. In the context of the life-course approach, excessive bodyweight among women of reproductive age represents a potential threat not only to themselves but also to their offspring. Those living in relative poverty are most at risk of developing excess bodyweight. The evidence appears to show that this differential is increasing, with obesity prevalence rising among low income younger women more rapidly than among better-off young women. This may represent a long-term threat to the health of the population through its action on the next generation. Similarly, there is some evidence that the social gradient in obesity is increasing for children. Those from lower income households are at greatest risk, and this risk appears to be rising more rapidly than it is for children in better-off households.

It follows that children in lower-SES households represent an immediate cause for concern, as they enter adulthood with a decade or more of overweight already behind them their health profiles will be already deteriorating. Their need for long-term treatment for a range of non-communicable diseases will be great, leading to a significant burden on health service providers. Furthermore, members of lower SEGs tend to be least likely to seek advice on preventive healthy behaviour – so that when they do seek treatment the severity of the disease is likely to be worse and the cost of treatment high.

3 The determinants of obesity inequalities

This section considers the links between obesity and the underlying health inequalities and why they persist in rich societies even where there are high standards of health. Explanatory mechanisms and hypotheses are outlined regarding the different prevalences of obesity in SEGs described in the previous section. The determinants of adult and childhood obesity are reviewed and the likely mechanisms, such as food and beverage intake, physical inactivity, psychological, cultural and societal factors and physiology are discussed. The reasons why these factors contribute to increased levels of obesity and the poor health observed in the lower socio-economic groups are described.

The section includes discussion of the lifespan and the interplay between biological and environmental determinants of health and bodyweight. This allows consideration of the appropriate responses to reduce the social gradient in obesity in later sections.

Main findings

- Dietary and physical activity patterns of lower SEGs show greater risk of positive energy balance (food energy intake exceeds energy output). Foods eaten by people in the lower SEGs are higher in energy and lower in micronutrients compared with higher SEGs. Members of lower SEGs eat less vegetables and fruit and children drink more soft drinks than those from higher SEGs. In general, adults and children, especially girls, from lower SEGs are less active and more sedentary.
- Lack of information concerning healthy dietary and physical activity patterns does not appear to be a barrier to members of lower SEGs, but ability and capacity to put these recommendations into practice may be a greater barrier.
- Women in lower SEGs may be more vulnerable than men to developing obesity because they are subjected to different environmental pressures including: less physical activity; pregnancy; discrimination in employment; family gate-keeper; and lower self-esteem associated with a failure to meet societal norms and models.
- Women in lower SEGs are more likely to be overweight before pregnancy and to gain more weight during or after pregnancy, putting a mother at increased risk of obesity.
- Women in lower SEGs are more likely to have under- and over-weight babies (both are risk factors for later obesity) and are less likely to follow recommended breastfeeding and infant feeding practices (also linked to obesity risk).
- Nationally representative health surveys are likely to under-represent the marginalized minority groups in society. Therefore representative health surveys among the socially marginalised people are needed.
- The percentage of disposable income and the absolute amount spent on food by members of lower SEGs should be calculated within each EU country, and this amount compared with both the cost of a healthy food basket and the levels of obesity.

3.1 Obesity and health inequalities

Within this report the term health inequalities is used to illustrate that social inequalities and their related impact on health are cumulative and run throughout the lifespan. For example social inequalities in mortality are substantial and almost half of the excess mortality in lower socio-economic groups is explained by the inequalities in cardiovascular diseases, which are obesity-related. Many EU countries have experienced an unexpected and significant increase in social inequalities over the past twenty years

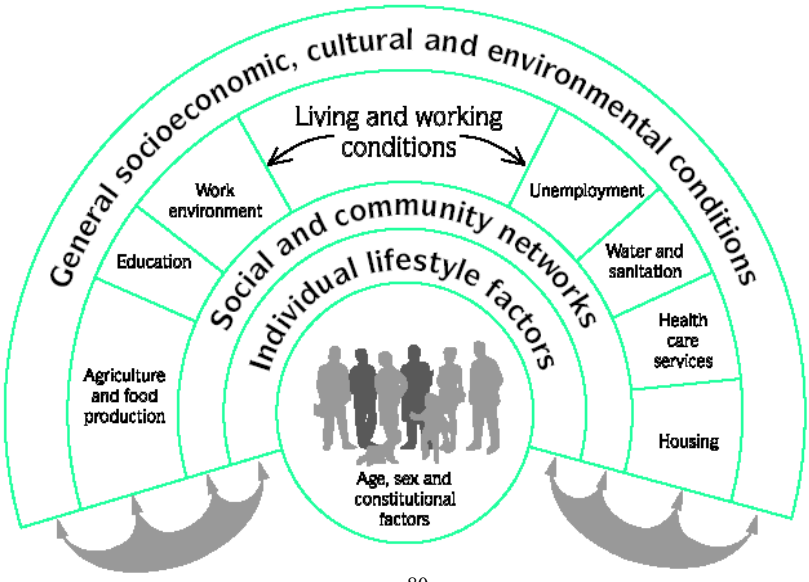
"without much evidence that the widening of the mortality gap will stop in the near future".[70] Social inequalities in self-reported morbidity may be even greater than the health divide in mortality. One study[71] that compared 11 EU countries showed that the risk of ill health (self-reported) was 1½ to 2½ times greater at the lower end of the socio-economic ladder compared with the higher end. Studies[72] also illustrate a gradient across society, and not just a gap between those having poor health at the lower social status extreme and those in good health at the other. Typically, a stepwise increase in health is seen with increasing social position and this is referred to as the social gradient. A social gradient is found for almost all common diseases.

A focus on gender-specific social differences in health is also important, as low-income women experience the double burden of being discriminated against for both being poor and being a woman. Social inequalities in health account for a substantial part of the total burden of disease in Europe. For example in Sweden, about one third of the total burden of disease is a burden that results from socio-economic inequalities in health, where ill-health is greater in unskilled workers. Considering that Sweden is an EU country with one of the lowest absolute socio-economic differences in mortality[73], it follows that the total burden of disease due to health inequalities is likely to be even greater within the EU. Efforts to reduce health inequalities are crucial and indeed, in some countries, health gains for the whole population will not be achieved without reducing the social inequalities in health.[74]

The social determinants of health are subject to positive, protective, or risky health factors: Positive health factors are, for example, economic security, adequate housing[75] and food and nutrition security; Protective factors are factors that reduce the risk of disease. Classic examples are immunization or food safety regulations that aim to protect against a variety of infectious diseases. Similarly healthy diets, such as the Mediterranean diet with a high consumption of vegetables and fruit, are also considered to be protective[76]; Risk conditions cause diseases that are potentially preventable. These can be social or economic risks or can be associated with specific environmental hazards, such as lack of provision of physical activity facilities or the choice of readily available foods limited to foods containing mostly fats, sugar and salt.

Dahlgren and Whitehead's diagram (Figure 3-1) emphasises the inter-connectivity where individual lifestyles are embedded in social and cultural norms, social networks and living and working conditions which in turn are related to the wider socio-economic and cultural environment. Environmental interventions have proven useful in reducing the consumption of alcohol and tobacco.[77] Just like alcohol and tobacco, changing eating and physical activity patterns does not rest solely on the shoulders of individuals[78], but can be facilitated by addressing the so-called obesogenic environments, namely "the sum of influences that the surroundings opportunities or conditions of life have on promoting obesity in individuals or populations".[79]

Figure 3-1. The main determinants of health



Source: Dahlgren and Whitehead [80]

3.1.1 Environmental factors linked to obesity

A WHO Expert Consultation on the prevention of chronic diseases including obesity gave a set of recommendations based on evidence summarised in table 3-1.[81]

Table 3-1 Summary of strength of evidence on factors that might decrease or increase the risk of weight gain and obesity[a]

Evidence	Decreased risk	Increased Risk
Convincing	Regular physical activity	Sedentary lifestyles
	High dietary intake of NSP (dietary fibre[b])	High intake of energy-dense micronutrient-poor foods[c]
Probable	Breastfeeding	Heavy marketing of energy-dense foods and fast food outlets[d]
	Home and school environments that support health food choices for children[d]	High intake of sugars sweetened soft drinks and juices
		Adverse socio-economic conditions[d] (especially for women)
Possible	Low glycaemic index foods	Large portion sizes
		High proportion of food prepared outside the home
		"Rigid restraint/periodic disinhibition eating" patterns
Insufficient	Increased eating frequency	Alcohol

Source: adapted from WHO/FAO 2003

[a]Strength of evidence: randomized controlled trials were given prominence as the highest ranking study design; associated evidence and expert opinion was also taken into account in relation to environmental determinants (direct trials were usually not available).

[b]Specific amounts will depend on the analytical methodologies used to measure fibre.

[c]Energy-dense and micronutrient-poor foods tend to be processed foods that are high in fat and/or sugars. Low energy-dense foods, such as fruits, legumes and vegetables and whole grains, are high in dietary fibre and water.

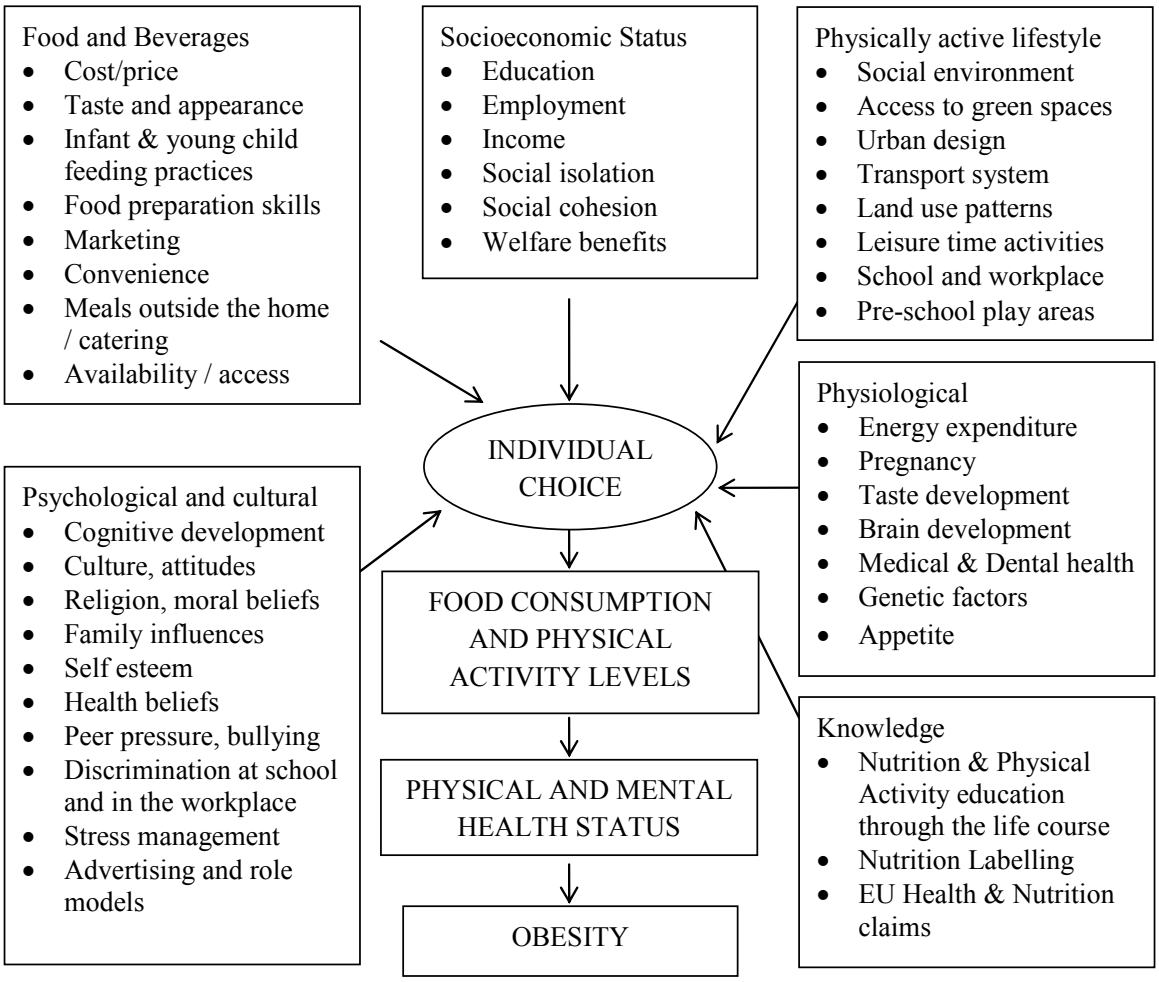
[d]Associated evidence and expert opinion included

In most societies, globalisation of markets, economic development and media and marketing influence individual behaviour, and influence populations to differing extents depending on regional, national and local factors.[82] Thus the socio-economic inequalities in obesity are the result of a combination of multiple risk factors having a complex interrelationship between micro- and macro-environmental determinants.

For example, whether a woman breastfeeds her child, or not, can be influenced by a combination of factors including: her economic situation; access to paid maternity leave; her access to optimal maternal services and health care; her level of education; aggressive marketing by baby food companies; her cultural environment; and her personal beliefs.

Individuals lower down the socio-economic ladder may be more exposed to an environment which combines a poor diet, lower physical activity levels, lower self-esteem and reduced access to health care and social services and other forms of social support. These in turn are linked to health behaviour and risk of obesity and, as demonstrated earlier, there is an association between low socio-economic status and obesity, especially in reproductive-age women and children. Figure 3.2 outlines the key determinants of obesity that affects the choices of individuals in the general population.

Figure 3-2. Key determinants of obesity



Source: adapted from figure 1 in Health and Human Nutrition: Elements for European Action. Société Francaise de Santé Publique. An independent expert report commissioned by and published under the auspices of the French Presidency of the European Union 2000.

3.1.2 Socio-economic Status

There is a need to explore and better understand the key determinants of obesity within a socio-economic frame-work. Intuitively it is hard to understand how poverty and the lack of food can result in obesity, which is acknowledged to be due to excess food energy intake. For example how can a family with too little money, and therefore restricted household budget, have family members, especially the mother, who are obese? More research is needed; however, a review by Burns[83] describes a strong relationship between poverty, food and nutrition insecurity and obesity: those individuals who were food insecure had a 20 to 40% higher risk of becoming obese and women were the most vulnerable.

Burns reviewed the literature describing the associations between poverty and food and nutrition insecurity plus obesity across three continents, including Europe. As yet the association observed between food and nutrition insecurity and obesity has not been clearly explained. One of the theories put forward by Drewnowski and Spector[84] is that it is relatively inexpensive to become obese. At world market prices, fats and sugars are cheap sources of food that satisfy the physiological drive for energy. This encourages higher energy intakes which are reinforced by the tastiness of these energy dense foods. In comparison Burns offers an anthropological hypothesis where poor diet, physical inactivity and weight control are the product of differences in culture and attitudes to health in the lower SEGs compared with those in middle or upper classes.

Burns cites research carried out in Finland[85] that shows how people change their lifesyle in response to economic hardship. The Finnish study showed an association between economic disadvantage, food and nutrition insecurity and body weight and low household income, recent unemployment and economic problems in childhood were all predictors of food and nutrition insecurity. The obese reported buying cheaper food due to economic problems and feared running out of money to buy food. Similarly, in the UK, Wardle[86] found that the risk of being obese was 40% higher in those receiving welfare benefits. Being a recipient of welfare benefit appears to have a strong association with both nutrition insecurity and obesity. Wardle noted that the effect of poverty, as indicated by the receipt of welfare benefits, on obesity appeared to function independently of the effects of occupation and education.

Education

From the Eurobarometer Health and Food study 2006[87] 41% of those who left school early and 31% of women, reported that they were prevented from performing normal daily activities because of a health problem. The Eurobarometer study also confirms the findings that those with longer education appear to weigh the least. Investigations into socio-economic patterns show that an obese child from a disadvantaged home is likely to have lower IQ levels and gain fewer educational qualifications.[88] If the obese leave school at the minimum age they are likely to enter the unskilled labour market where low pay is combined with a low pension. Earning a low income reduces access to a full range of healthier food and opportunities for physical activity and further increases the risk of developing obesity. The link between education policies and obesity is becoming stronger as more evidence emerges.

3.1.3 Determinants of obesity associated with lower socio-economic status

In the following pages the factors affecting obesity and how these link to social inequalities are discussed in more detail. Table 3-2 lists some of the key determinants of obesity which have a social gradient.

Table 3-2: Examples of determinants of obesity linked to low SES

Physiological factors
High parental, especially maternal, weight
Greater maternal weight gain during pregnancy
Poor weight loss after pregnancy
Unhealthy birth-weight (low & high)
Poor dental health
Food and beverage intake
Little or no breastfeeding, early weaning
Higher consumption of fast food
Higher soft drink consumption
Lower vegetable and fruit intake
More vulnerable to food marketing
Missing breakfast
Physical activity levels
Lower physical activity levels
More TV watching and sedentary activities
Less access to leisure facilities
Psychological and cultural factors
Poor cognitive development and lower IQ
Low self-esteem and behavioural problems

Physiological factors

Growth throughout the lifespan is influenced by complex interactions between genetic potential, energy and nutrient availability, medical conditions and the hormonal milieu.[89] The effects of birthweight and unhealthy weight gain persist from generation to generation. Biological programming during pregnancy and infancy, being born with an unhealthy birthweight (too low or too high) and parental obesity are all mediated by the environment where people live. In addition new evidence demonstrates the importance of healthy infant feeding practices and nutrition security at a very early age especially through taste development and optimal brain development.

Many people develop medical conditions related to obesity most notably type 2 diabetes (traditionally adult-onset but now increasingly seen in children). In addition to medical health, good dental health is essential for nutrition security. Healthy teeth and gums enable the consumption of a healthy diet rich in fresh fruits and vegetables. It is well recognised that people within the lower socio-economic groups have a higher risk of poor dental health.[90]

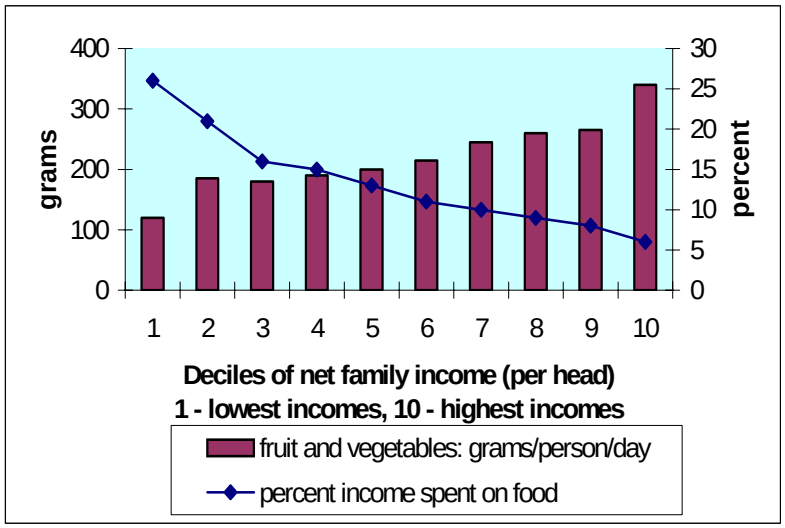
Food and beverage intake

According to Eurobarometer one third of European Union citizens believe that it is not easy to eat a healthy diet.[91] In the 2006 Eurobarometer survey 57% unemployed people,

60% Manual workers and 61% students stated that it was not easy for them to eat a healthy diet. Similarly around 50% of respondents in the new EU Member States stated that it was not easy to eat a healthy diet. In contrast people with the longest education, senior managers, employed people, and those living in large towns are more likely to change what they eat or drink.

In a pan-European study concerning determinants of food choice, the cost of food was most important for unemployed and retired people on low incomes.[92] The cost of food is a key determinant to dietary patterns and research confirms that food prices explain why poorer people have less healthy diets. A good indicator for food security is the proportion of household expenditure that must be devoted to food to ensure adequate nutrition. For example spending a high proportion of income on food indicates that households are likely to have trouble ensuring a sustainable supply of nutritious food. For example purchase of fruit and vegetables is a problem (Table 3-3) for the lower income groups in the UK. The average expenditure on food, as a percentage of total household expenditure in 2000, in the UK was 18%. However the highest income groups were spending only 6% of their disposable income on food compared with 27% in the lower income groups.

Table 3-3. Relationship of intake of fresh fruit and vegetables to the share of income spent on food in the UK



Source: Adapted from Food and Health in Europe, WHO 2004[93]

In Ireland, lower income households need to spend 35% of the household income in order to purchase a healthy food basket. For the lowest income households, where a household is dependent on welfare benefits, the figure rises to 42% of the weekly household income needed to purchase a healthy food basket.

There is considerable evidence from surveys of low income households that food expenditure is the most flexible item in the budget, and that when money is particularly short, food purchases are reduced to the minimum.[94] [95] [96] Food that satisfies hunger is likely to be rich in calories but poor in nutrients and can provide 300 - 1000 kcal for less than €1.[97] In contrast many of the foods recommended for healthy diets, such as lean cuts of meat and most fruits and vegetables, provide fewer than 200 kcal per €1.

Hunger can be satisfied on a low budget but micro-nutrient intake is likely to be compromised. Mothers may have to cut back on healthier foods in order to afford necessary purchases for children. Food shopping may be dictated by children's tastes and

children often will not eat unfamiliar foods[98] and so a limited family budget cannot be used for unfamiliar vegetables and fruits that may be wasted. Low income mothers know which foods are healthy and try to provide these for their families but financial difficulties and physical inaccessibility make it impossible.

In the 2006 Eurobarometer survey, "lack of time" and "lack of control over what they eat" were reported as the two main reasons why respondents, including the lower SEG, find difficulty in eating a healthy diet. However the "cost" or "access" to a healthy diet was not included among the Eurobarometer options. Future Eurobarometer studies should include the "cost" or "access" of eating as a potential barrier to eating a healthy diet. Indeed the lower SES respondents were aware that they ate unhealthily. For example 71% of the unemployed and the majority of respondents from the new Member States believed that they did not eat a healthy diet and the lack of information, concerning what constitutes healthy eating, was not considered a major barrier.

The barriers most relevant for low income groups include affordability, accessibility, availability, attractiveness, appropriateness, and practicality rather than lack of information.[99] Studies suggest that energy-dense foods provide dietary energy at lower cost than do lean meats, fish, fresh vegetables, and fruit.[100] In a study of French adults' purchasing patterns[101] foods high in fat, sugar, and grains were associated with lower costs. For most levels of energy intake, each additional 100 g of fats and sugars was associated with a small percentage reduction in diet costs, whereas each additional 100 g of fruit and vegetables was associated with a small percentage increase in diet costs. The relatively low cost of food energy (cost per calorie) of fatty and sugary foods, combined with their high palatability, high convenience and large portion sizes[102] [103] are all likely to contribute to weight gain. Studies among poor families show that the price of fruit and vegetables is about 30 to 40 percent higher and the availability is lower compared with better-off areas.[104]

The percentage of disposable income spent on food gives an indication of how severe nutrition insecurity is likely to be. Even in the rich EU countries people may face food and nutrition insecurity and health inequalities.[105] According to 2004 figures from Eurostat[106] the average disposable income spent on food within Europe varies from less than 10% in Luxembourg, UK and Ireland; less than 15% in Norway, Iceland, Spain, France, Belgium, Finland, Sweden, Germany, Denmark, Netherlands and Austria (in descending order); all others spent between 15-20% on food and non-alcoholic beverages except for Latvia, and Lithuania (both between 20-30%) and over 30% of household expenditure was spent on food and non-alcoholic beverages in Romania. However, as seen above with regards to UK and Ireland, these national percentages are population average figures and conceal the major inequalities that can exist within each country. Therefore more information is needed on both the distribution of the percentage income and the absolute amount spent on food by the different SEG and the cost of a healthy food basket within each EU country.

Access to a healthy diet

The most economically deprived urban areas reported to have around four times more fast food outlets than the least deprived areas.[107] [108] Moreover aggressive marketing of energy-dense, micronutrient-poor foods and beverages also plays an important role in unhealthy food purchases.[109] [110] [111] Reviews of population-based studies show that individuals from lower socio-economic groups have significantly lower intakes of healthy foods (such as fruit, vegetables and high-fibre products such as brown bread) and higher intakes of less

healthy foods such as (full-fat milk, higher fat meat products, sugars and potatoes).[112] [113] [114] The EU-funded FAIR project reviewed dietary intake research carried out in 15 European countries and found that those adults belonging to lower socio-economic groups exhibited less healthy nutritional behaviour[115] and concluded that:

- low-income households eat less well and have inferior food intake and lower compliance with dietary recommendations and nutrient intake
- low-income households, while spending a relatively higher share of income on food, have difficulties accessing a variety of good quality, affordable food
- low-income households know what are healthy food options, but their choices are restricted by financial and physical constraints and psychological needs.
- low-income households are restricted socially and culturally in their food consumption patterns due to financial constraints.[116]

Beverages and alcoholic drinks

A systematic review in 2006 concluded that a greater intake of sugar-sweetened beverages is associated with weight gain and obesity.[117] School-aged children with lower parental education appear to consume greater amounts of soft drinks.[118] The 2004 UK survey of low income families showed children to be drinking an average of 400ml of sugared soft drinks daily compared with 260ml per day reported for children in the population generally.[119] [120]

Alcohol, as well as soft drinks, is a concern for adult obesity. Alcoholic beverages can make a substantial contribution to daily energy intakes[121] and research shows that, in men aged from 40 to 59 years, body weight increases significantly as alcohol consumption rises. In Scotland heavy drinkers (defined as those drinking more than 21 units of alcohol per week) had the highest prevalence of obesity but were also more likely to lose weight if their alcohol intake declined. One in 10 Europeans drinks five or more drinks in one session.

The contribution of rising alcohol consumption in relation to obesity levels needs to be investigated and it is unclear to what extent and for which social groups alcohol consumption is a determinant of obesity. Self-reported alcohol intake data[122] suggest that binge drinking is more common among women in deprived areas and the most common drinking location was in their own home. The relationship between alcohol intake and being obese appears to have been overlooked and future strategies to reduce the rise in obesity in Europe will need to consider how best to monitor and reduce alcohol intake within vulnerable groups. Concerns about alcohol ought to be included into social and health policies dealing with obesity, given that both prevention strategies seek to reduce consumption levels.

In conclusion the cumulative result of food and beverage intake is that the diets of lower income groups tend to be relatively high in energy and low in micronutrients compared with those in higher income groups.

Physical activity

The social and built environment, transport systems and urban design, as well as school and work environments all contribute to exacerbating inequalities in physical activity levels.[123] [124] Lower SES tends to be inversely related to participation in leisure time

physical activity, which may be related to low income groups having less leisure time and less access to exercise facilities and green spaces.[125] [126] Socio-economically deprived neighbourhoods have few places that encourage a healthy lifestyle such as safe streets and pavements, parks, paths and community gardens.[127] When low income groups choose to be active they often face safety risks related to traffic or crime and it appears they are more likely to travel longer distances by walking or by bus, and so better access to public transport is important to encourage more walking.[128]

Walking

Two Eurobarometer studies conducted in 2003[129] and 2006[130] indicate that physical activity levels in the EU are low. The percentage of respondents declaring that they never walk for at least 10 minutes at a time decreased from 21% in 2002 to 13% in 2005. In both 2005 and 2002 the average number of days that included walking was around 4½ days per week. The average walking time varied between countries with Malta, Cyprus and Portugal spending least time (around ½hr) and Slovakia walking most (between 2 and 2½ hours at a time). Younger people, those living in larger cities and those with longer education were the most frequent walkers and the level of walking appeared to decrease with increasing body weight.

Commuting, housework and sedentary lifestyle

Eurobarometer studies found that on average around one third of EU respondents get no physical activity when commuting to and from the work place, however answers between countries varied considerably. Younger people, workers of manual labour, the unemployed and students were the most physically active when travelling from place to place. Both the 2003 and 2006 Eurobarometer surveys revealed that women get more physical activity than men at housework. In 2006 the average time citizens spent sitting exceeded 5 hours a day in 16 out of 25 countries: the time spent sitting varied from just over 3 hours in Portugal to more than 8 hours in the Netherlands.

Vigorous and moderate physical activity

In both Eurobarometer surveys the number of days with vigorous physical activities was around 1½ days per week on average in the EU. People in the Baltic countries were most active with Lithuanians and Estonians spending 2.8 and 2.3 days/wk respectively on vigorous physically active. The Maltese and Spanish were least active with only 0.8 and 1.0 days/wk respectively spent on vigorous activity. The average duration of physical activity during the day varied considerably between countries with Malta spending only around ½ hr/days and Slovakia spending just under 3 hours per day on vigorous activity. The number of days devoted to moderate physical activity was similar in both 2003 and 2006 with EU citizens spending around 2½ days on average on moderate activity: Maltese citizens spending least (0.6 days) and respondents from the Netherlands spending most days (4.6 days) per week on moderate activity.

Physical activity at work

On average around 50% and 60% of respondents in the 2003 and 2006 surveys respectively get little or no physical activity at work. The amount of physical activity at work varied considerably between Member States. In 2006 survey 19% of Dutch citizens and 31% of Irish citizens declared that they perform no physical activity at work, compared with 55% in Greece and 61% in France. The 2006 study reveals that men, aged 25-54, and those who finished their studies between the ages of 16 and 19, get most physical activity at work.

Access to facilities to enable physically activity

According to the 2006 Eurobarometer survey, almost 57% respondents said they had done little or no physical activity in their leisure time compared with 46% in the 2003 survey. The physical activity rates varied considerably between countries both in the 2003 and in the 2006 study but in general women, do less sport than men. Similarly those with lower education compared to those with higher education take less exercise. Over one quarter of European Union citizens (27%) state that they do not have many opportunities to be physically active near where they live. The percentage is even higher in the new EU Member States, with around 40% of respondents stating that they do not have many opportunities to be physically active. Similarly 25% on average of EU citizens consider that local sports clubs and centres do not offer sufficient opportunities to be physically active, with a greater proportion (around 40%) stating this in the new Member States. The countries where respondents declared that they never perform vigorous physical activity are also those countries where respondents declared that local opportunities for physical activities are inadequate. The majority of respondents in the new Member States, the candidate and accession countries are not satisfied with their opportunities to be physically active. Finally, just over half of the people interviewed in the 2006 Eurobarometer survey stated that they did not have enough time to be physically activity and the majority (85%) were in favour of government action to support people to take more exercise. The findings from the Eurobarometer surveys confirm the results from other studies which show that adults and children from lower SE groups tend to be less physically active and more sedentary than those with a higher SES.[131] [132]

Psychosocial, cultural and emotional

In Westernized societies there are powerful messages that adults, especially older children and women, should be thin, and that to be fat is a sign of poor self-control.[133] [134] Negative attitudes about the obese are widely held, and have been reported among health care professionals and among the overweight themselves.[135] [136] A number of reviews have been published on the psychosocial aspects of obesity.[137] Several European studies in general populations found significant differences in psychological status between the obese and non-obese and suggest a relationship between obesity and emotional problems (e.g. Lissau & Sorensen 1994[138]). However more focused long-term studies are needed, especially to study the impact on women.

Knowledge

Although healthy eating campaigns and messages have brought about changes in knowledge, awareness and motivation, and have influenced the food purchasing and consumption patterns of more affluent groups, there remains a strong demand for 'unhealthy foods' within lower social economic groups. There are serious inequalities in resources that are available to health educators compared with those that are available to the industry: the UK Department of Health noted that their national food-related health education budget was some £7m in 2004, at a time when the food industry spent some £740m on advertising their products.[139]

It is however important that policy makers do not depend on health education alone for tackling the obesity epidemic. Not only is health education information liable to be undermined by messages from commercial sources, but different social groups are likely to experience significant differences in their ability and capacity to put the message into practice, potentially increasing the social gradient in obesity. The 2006 Eurobarometer survey confirmed that the lack of information, concerning what constitutes healthy dietary

and physical activity patterns, was not considered a major barrier in the lower SEGs. As suggested above, motivation, lack of access, unavailability, and financial constraints may present greater barriers.

3.2 Critical points for the development of obesity through the life course.

In this section the key determinants of the social gradient in obesity are considered at different stages throughout the lifespan. Some of the determinants have a greater impact than others at different life stages. For example physical activity patterns have a greater impact on the weight of school-children compared with infants, whereas breastfeeding and infant feeding practices are important in the early months, and nutrition security is likely to be important throughout the whole of life.

The fact that socio-economic inequalities interact with nutritional health throughout the life course is well recognised. For example parental social class is a predictor of birthweight[140] so that infants born with an unhealthy birthweight are more likely to be born into more disadvantaged families.[141] Similarly maternal obesity, more prevalent in the lower SEG, increases the risk of women delivering an infant with high birthweight or with birth defects, such as neural tube defects.[142] The combination of the socio-economic factors and the inter-generational effects[143] [144] suggest that the social gradient related to obesity is reinforced throughout life. Research into biological programming has shown an association between foetal development and obesity related chronic diseases.[145] [146] Similarly research into socio-economic status shows that an obese child from a disadvantaged home is likely to have a low IQ levels and obtain few educational qualifications.[147]

Body weight matters at all stages of the life course and effects of both underweight and overweight persist from generation to generation. Giving birth to an unhealthy weight infant (either low (Figure 3-3) or high (Figure 3-4)) is associated with the development of obesity. Thus biological programming is interwoven with the impact of the social environment even before birth. In figures 3-3 and 3-4 some of the underlying mechanisms and the interactions between physiology and social and cultural aspects, including dietary and physical activity patterns, throughout life are illustrated. These interactions are discussed in more detail below.

Figure 3-3. Lifecourse: Undernourished mothers, low birth-weight infants and risk of obesity.

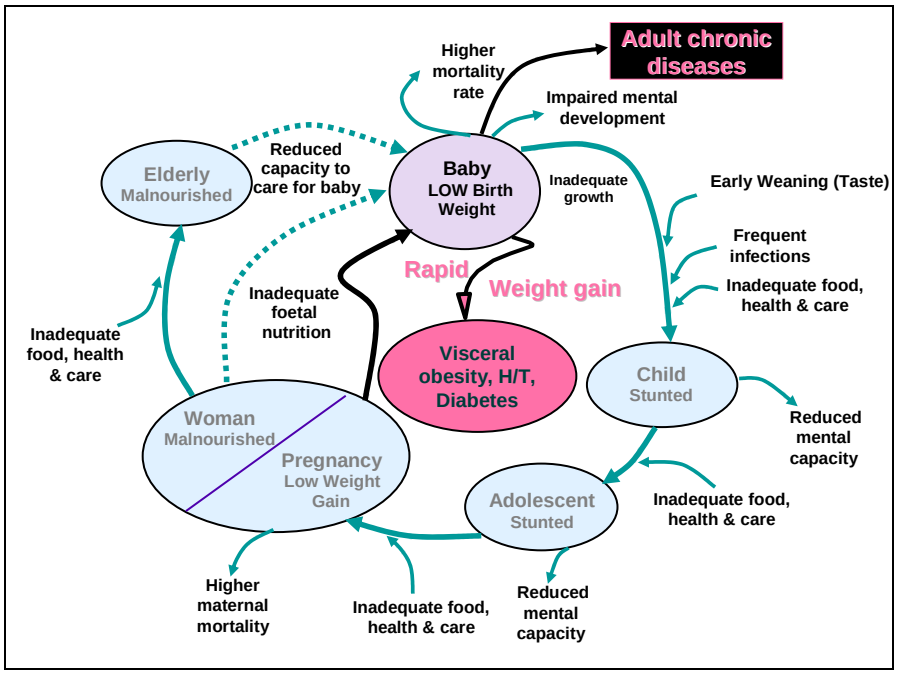
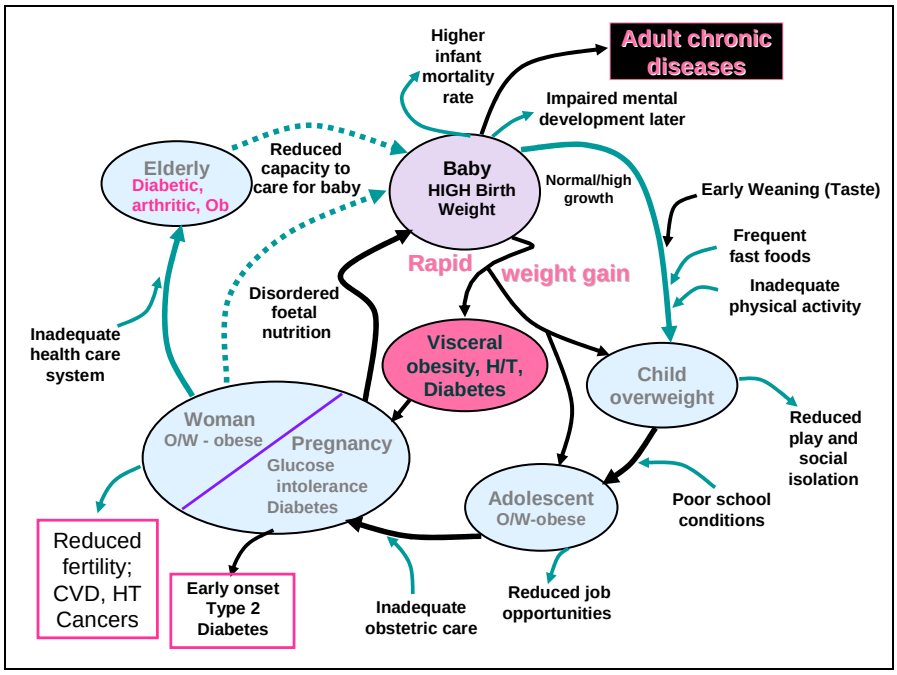


Figure 3-4 Lifecourse: Obese mothers, high birth-weight infants and risk of obesity.



Source (both figures): James and James (personal communication) adapted from ACC/SCN 2000[148]

3.2.1 Maternal health

3.2.1.1 Socio-economic status

Obesity occurs in pregnant women when there is over-consumption of energy relative to energy expended. In low socio-economic groups the quantity of food energy may be excessive whereas the food and nutritional quality (essential nutrients, anti-oxidants, vitamins and minerals) may be poor.[149] [150] Kramer et al discuss the socio-economic disparities in pregnancy[151] and suggest clear links between obesity and co-existing deficiency disorders such as anaemia. A healthy maternal weight, resulting from optimal dietary and physical activity patterns, is important prior to conception in order to positively influence the outcome of pregnancy but unfortunately women in low SEGs are the most vulnerable to developing an unhealthy maternal weight.

3.2.1.2 Underlying physiological mechanisms

Pre-pregnant weight – underweight

It may appear confusing to include underweight in a report concerning obesity. However, as outlined in figure 3-3 and discussed further below, if a pregnant woman is underweight her foetus may, via biological programming, be exposed to an increased risk of obesity and cardiovascular diseases in later life. Thus women with a low pre-conceptual weight (BMI<18.5), such as those in Hungary and Poland where 11% were underweight, have an increased risk of delivering low-birthweight infants who have a higher risk of developing abdominal obesity and diabetes type 2 in later life.

Adolescent mothers

Adolescent mothers in low SEGs may be at increased risk of having an unhealthy body weight. Adolescent mothers, if they are underweight, are at especially high risk of delivering a low birthweight infant[152] and, if they are overweight, they are prone to other complications including giving birth to a high birthweight infant (table 3-4). Adolescent pregnancy and early parenthood can lead to poor educational achievement, poor physical and mental health, poverty and social isolation for mothers and their children. The rates in most EU countries range between 13 and 25 pregnancies per 1000 girls aged 15-19 years and peak at around 50 per 1000 girls. For example adolescent (<18years) conception rates in the UK were among the highest in Europe at 44 conceptions per 1000 girls in 1998.[153] Factors that are strongly associated with high adolescent birth rates include: low income and the average length of education. Socio-economic disadvantage can be both a cause and an effect of young parenthood and so prevention of adolescent pregnancy requires action from a wide spectrum of policy makers.

Table 3-4. Increased risk of complications among overweight and obese pregnant teenage women.

	Incidence per 100 births among mothers with healthy weight (BMI 18.5-24.9)	Increased risk among overweight mothers BMI 25-29.9	Increased risk among obese mothers BMI 30-34.9
Obstetric complications			
Caesarean delivery	12.2	+29%	+79%
Cephalopelvic disproportion	9.3	+41%	+85%
Induction of labour	18.3	+24%	+46%
Gestational hypertension	4.5	+51%	+144%
Preeclampsia	2.4	+38%	+92%
Gestational diabetes mellitus	0.6	+83%	+183%
Gestational age 41 weeks or more	15.5	+28%	+17%
Neonatal complications			
Low birthweight	9.3	-26%	-23%
Small for gestational age	15.2	-21%	0%
Macrosomia (high birthweight)	5.9	+34%	+95%
Nonreassuring foetal status	7.1	+16%	+34%

Source: adapted from Sukalich et al 2006 [154]

Pre-pregnant weight - overweight

Unfortunately as seen in earlier sections, the rates of overweight and obesity are increasing among women of reproductive age and genetic makeup and physiology alone cannot account for this dramatic rise.[155] In some countries there is evidence of a doubling in the prevalence of obesity in women attending antenatal care (in some places almost 20% are now obese).[156] A study in UK[157] shows that the incidence of maternal obesity is both increasing and accelerating. The prevalence of obesity among women at the start of pregnancy has increased significantly over 15 years from about 10% to 16%. It is estimated that if the current rate continues the prevalence will have increased to 22% by 2010 and less than half (47%) of pre-pregnant women, compared with 65% in 2006, will have a healthy body weight. Moreover those living in deprived areas are almost 2½ times more likely to be obese at the start of pregnancy compared with the more affluent. The incidence of maternal complications (hypertension, Gestational Diabetes Mellitus (GDM), caesarean section, hospitalisation) increases with increasing BMI.[158] [159] For example a tenfold increase in the prevalence of hypertension is reported in obese pregnant women.[160] [161] In addition there is an increased risk of: congenital malformations,[162] such as neural tube defects[163]; delivering a high birth-weight infant (>4000 g)[164] and a raised risk of infant mortality.[165]

Overweight and smoking

Healthy weight women who stop smoking during pregnancy[166] [167] are likely to gain more weight during pregnancy and overweight women who stop smoking are especially likely to gain excessive weight. Fear of this excessive weight gain may be sufficient to discourage many women from stopping smoking during pregnancy in order to control their weight. Smoking rates of pregnant women are higher in the lower socio-economic groups and this illustrates how the interaction between several lifestyle behaviours and physiology exacerbates the health inequality gap between the lower and higher socio-economic groups.

Weight gain during pregnancy

Surveillance data concerning weight gain during pregnancy are hard to find in Europe. Indeed these data are apparently not monitored routinely perhaps because most EU countries have not implemented official recommendations on how much weight should be gained during pregnancy. Most EU countries appear to use the US recommendations (Table 3-5) as a guide. In the USA, a 1996 survey found about 44% of pregnant women gained more weight than recommended[168] and these were predominantly low-income women.

Table 3-5. Recommended weight gain during pregnancy (duration of 39-41 wks and birthweight of 3-4kg)

Pre-pregnant BMI of women	Weight gain (kg)	Weekly rate of weight gain (2^{nd} & 3^{rd} Trimester) (kg)
BMI < 19.8	12.5 to 18	Slightly >0.5
BMI > 19.8 to 26	11.5 to 16	0.5
BMI > 26 to 29	7 to 11.5	0.3
BMI >29	≤6	0.3

Source: Institute of Medicine 1990.[169]

From the limited data available in Europe it appears that an alarmingly high proportion of women probably exceed the IOM guidelines for weight gain during pregnancy. For example in Denmark, 78% of overweight women, especially those who were already overweight before pregnancy, exceeded the IOM recommended gestational weight gain.[170]

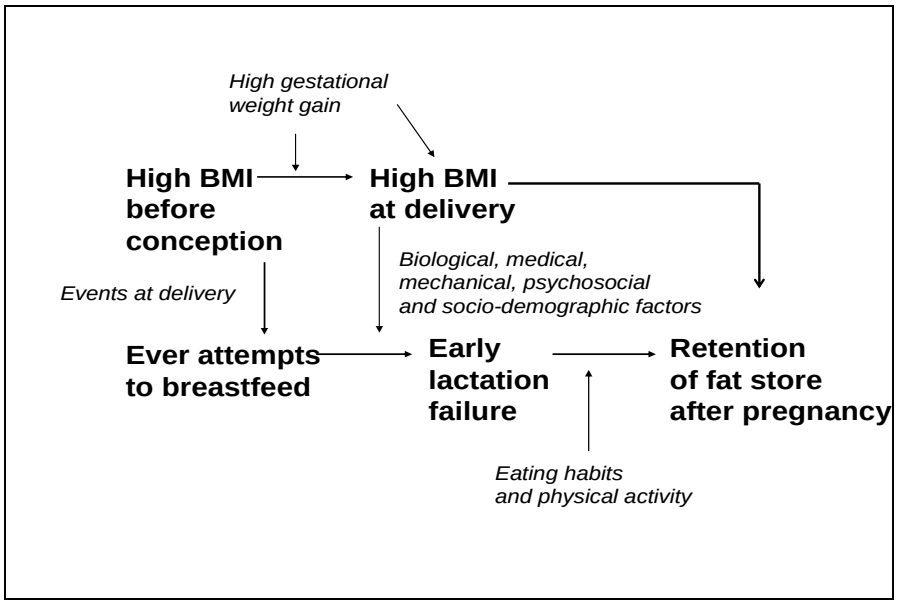
A certain amount of weight gain during pregnancy is desirable. The placenta and foetus itself, expanded blood volume, uterine enlargement, breast tissue growth, and other products of conception generate an estimated 8-9kg of extra weight. Weight gain beyond this is predominantly maternal adipose tissue and the deposition of 2 to 2.4 kg provides an energy reserve for lactation.[171]

Women who are overweight or obese at the onset of pregnancy are advised (table 3-5) to gain less, although the IOM recommendations advise against limiting energy intake to induce weight loss during pregnancy. Weight gain recommendations are not absolute requirements, but rather suggestive guidelines which may be modified in the course of pregnancy. Recently it has been suggested that the 1990 IOM recommended weight gains are too high. The new recommendation being considered is that women with a normal pre-pregnant BMI should not gain more than around 11.4 kg[172 173] compared with 16.0 kg in the 1990 recommendations.

Weight retention after pregnancy

If the adipose tissue gained during pregnancy is not lost this results in maternal weight retention after birth. Weight retention after pregnancy may reflect reduced energy expenditure through decreased physical activity or it may reflect a pattern of increased energy intake acquired during pregnancy.[174] Excessive weight gain during pregnancy is a strong predictor for sustained post-partum weight retention.[175 176]

Figure 3-5. Risk model for obese low-income women of reproductive age



Source: Adapted from Professor Kathleen M. Rasmussen Cornell University, personal communication

Women often state anecdotally that weight gain during pregnancy and the resulting weight retention is the reason for them becoming obese (Figure 3-5). For example a study in the UK[177] showed that maternal weight gain is the result of both retained and additional weight gain after delivery. Mothers who felt that they ate more after their children were born had significantly greater long-term weight gains than those who felt that they had not increased their food intake. In the US around 42% of women reported retaining ≥4kg of their gained weight during pregnancy and around one third reported ≥6 kg of retained weight gain.[178] Retained weight gain of 2 to 3 kg was also reported as a result of the first pregnancy.[179] Mothers from low SEGs appear to have more difficulty in losing the excess gestational weight gain after birth. For example in Denmark it appears that women who are unskilled or unemployed retain more weight at 6 months post-partum compared with the highly skilled or well educated (Jennifer Baker personal communication) and similar results are seen in the US.[180] There are few studies reporting weight gain 1 to 2 years after pregnancy.[181]

Additional pregnancies

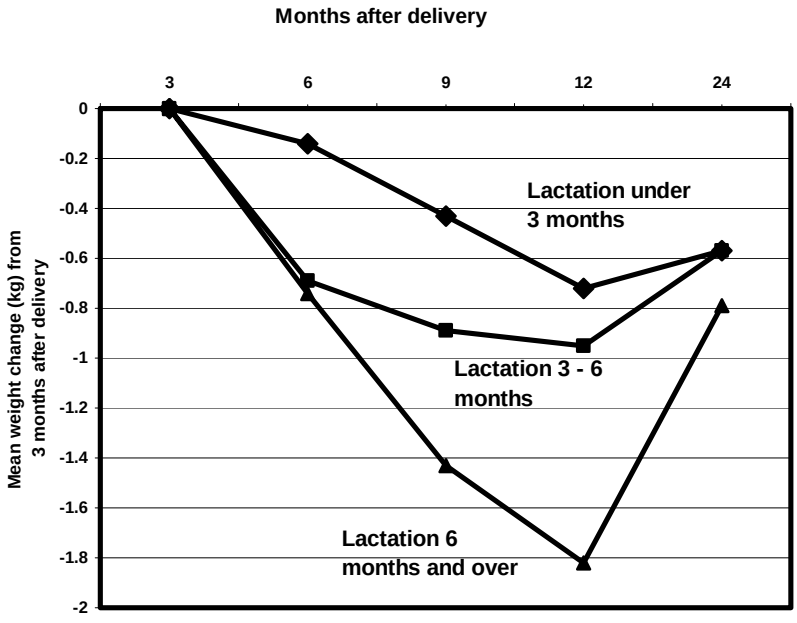
The prevalence of obesity appears to increase with additional childbearing. The mechanisms are either through excessive fat gain during pregnancy and/or failure to utilize these fat stores. Results from a US study suggest that both the socio-demographic and behavioural factors, in addition to a higher weight at the beginning of pregnancy, increase the risk of weight gain with each additional pregnancy.[182] In a 10 year prospective study in US, the average weight gain for women who gave birth at least once was about 2 kg more than women with one pregnancy.[183] In another study around one fifth of the mothers weighed at least 5 kg more 6-18 months after delivery compared with prior to pregnancy.[184] In Sweden[185], women who retained weight after their first delivery have a higher risk of doing so in subsequent pregnancies. The good news is that maternal adipose tissue can be utilized during lactation.[186]

Lactation and weight retention post-partum

McKeown and Record[187] showed the effect of lactation (Figure 3-6) by comparison of the weight of women according to the period of lactation (< 3 month, 3-6 months and >6

months). They concluded that the amount of weight lost increases as the duration of breastfeeding increases to around 6 months and more.

Figure 3-6: Duration of lactation and weight change after delivery



If maternal adipose tissue laid down during pregnancy to prepare for lactation is not used as an energy source for milk production, the additional fat may be retained. A study in Denmark (Jennifer Baker personal communication) suggests that both full and partial breastfeeding even among women who are obese before pregnancy and have a high weight gain during pregnancy can help to decrease weight retention after pregnancy. Women who had a gestational weight gain of less than 15kg and fully or partially breast fed for more than 16 weeks retained the least weight and there was a tendency for the unskilled/unemployed to retain more weight compared with the more highly skilled (Jennifer Baker personal communication). Therefore if breastfeeding continues for at least 6 months postpartum mothers have a greater chance of losing more weight than non-breastfeeding mothers.

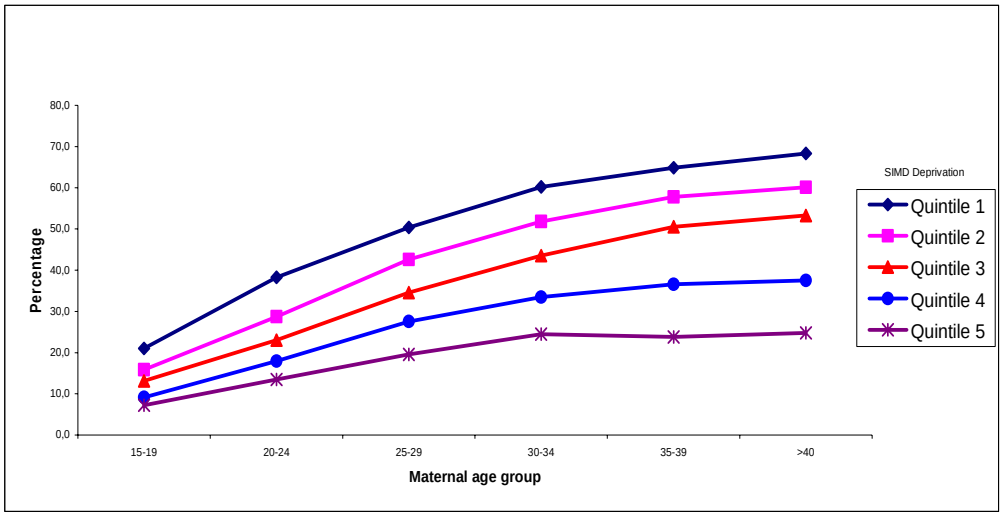
Obese women are at increased risk of not breastfeeding

Unfortunately women who are overweight or obese before pregnancy are less likely to initiate breastfeeding and they discontinue breastfeeding earlier than do normal weight women.[188 189] The mechanisms are not completely understood but are likely to be multi-factorial including mechanical difficulties of proper positioning of the infant. In addition physiological differences, such as lower prolactin production levels, appear to exist in obese women and a high pre-pregnant weight is associated with a longer time before breastmilk is secreted.

Obese women in low socio-economic groups appear to have personal, social, and economical issues which may influence their decision not to breastfeed. For example Scottish data show maternal age and deprivation have an independent effect on breastfeeding at 6-8 weeks (Figure 3-7). Breastfeeding rates are lower in the most deprived areas and within each deprivation quintile breastfeeding rates improve as maternal age increases. Older mothers are more likely to breastfeed than younger mothers.

Only around 12% younger mothers (15-19 age group) in the most deprived areas were breastfeeding just after birth compared with 31% mothers aged more than 30-34 years. In the most affluent areas the breastfeeding rates are 35% among young mothers (15-19 age group), compared with double this (70%) in mothers older that 30 years. At 6-8 weeks (Figure 3-7) in the most deprived areas only 7% young mothers breastfed (15-19 age group), compared with around 70% of older mothers in the most affluent areas.

Figure 3-7. Breastfeeding recorded at the 6-8 week review, by maternal age and deprivation quintile* (children born 1999-2004).



Source: CHSP-PS ISD Scotland February 2005; *Scottish Index of Multiple Deprivation .[190]

3.2.1.3 Diet and physical activity during pregnancy and lactation

Diet

Generally, well-nourished women need only a small increase in energy intake (about 200 kcal (837kj)/day) in the last trimester of pregnancy.[191] Individual energy intake should be adjusted according to pre-pregnancy nutritional status and physical activity. A study in Iceland investigated the association of maternal dietary intake in pregnancy along with gestational weight gain. Not surprisingly the total energy intake was highest in the group gaining excessive weight in late pregnancy.[192] The energy requirements of lactation are greater than those of pregnancy. This extra energy for lactation can be met partly by maternal adipose tissue accumulated during pregnancy and partly by food energy. In Europe average recommended increases in energy intake during lactation range from 380 to 500 kcal (1591-2093 Kj) /day.[193] In the USA the IOM recommends that lactating women consume at least 1800 kcals (7530 kj) per day.[194]

The increased requirements of micronutrients during pregnancy and lactation have to be met by eating a diet rich in nutrients. The pre-pregnancy dietary intake is often found to be inadequate to meet the increased micro-nutrient needs. Kramer showed the co-existence of obesity and deficiency disorders such as anaemia and similarly a Finnish study reported that the folate, vitamin D and iron intakes were low in pregnant women.[195] Studies from the UK showed that intake of vitamin D, folate[196], iron and selenium in pregnant women were below recommended.[197] Similar results were found in Austria where the diet of pregnant women was not very different from that of non-pregnant women[198] and women with a lower educational level or lower income were at greatest risk of poor nutrition.

As discussed elsewhere the ability to make healthy dietary choices is closely related to socio-economic considerations and there is a tendency for the poor to eat less healthily than the most affluent, starting with foetal life, which has consequences for the risk of obesity in adulthood.[199] [200]

Physical activity

Women of reproductive age benefit from physical activity daily. Daily moderate physical activity is generally safe during pregnancy but extreme fatigue in pregnant women may suggest that activity has been excessive.[201] Studies on physical activity during pregnancy traditionally concentrated on the safety of the pregnant mother and the foetus. Risks, such as possible miscarriage, maternal injury or increased uterine contractility were investigated. However more recent studies demonstrate that regular moderate exercise has several beneficial and no adverse effects on the mother and the foetus.[202] [203] Nevertheless, as yet, little information is available on the impact of physical activity on weight development during or after pregnancy. The results of intervention studies examining the associations of physical activity and weight development during pregnancy have been inconsistent and the study populations small (Riitta Luoto personal communication). However, studies examining the association between physical activity and postpartum weight retention have shown that post-partum weight retention was lower in women who were more active compared with less active women (Riitta Luoto personal communication). Prospective controlled trials are needed to examine the preventive effects of physical activity on weight gain during pregnancy and weight retention after pregnancy, especially in women from lower socio-economic groups.

Moderately increasing physical activity and decreasing energy intake does not adversely affect breast milk production or infant growth among overweight women.[204] Women who have higher levels of education or income are more likely to have higher levels of physical activity.[205] Women in lower SEGs appear at greater risk of adopting poor eating and physical activity behaviours.[206] For example, mothers in Norway who did less exercise after pregnancy than they did before were at greater risk of long term weight gain.

3.2.1.4 Psychosocial determinants of maternal weight

In addition to its health and economic impacts, obesity can have major psychosocial impacts. In their review of the literature, Pomerleau et al found that obesity is a stigmatised condition in most societies, and stigmatisation is itself associated with poorer health, economic and social outcomes.[207] Weight-related discrimination is known to occur in relation to marriage and occupation. A factor which modulates the association of SES and adult obesity is the upward or downward change in social status from one generation to the next (social mobility).[208] Longitudinal studies have shown that the women who experience upward social mobility had lower levels of adult obesity compared with those who remained in the same social class as their parents, or compared with those whose SES declined.

Conclusion on maternal health

The long-term effects of obesity on women's health and the health of the next generation provide robust evidence for advocating healthy weight management support for low income reproductive-age women before, during and after pregnancy.[209] Pregnancy, as a crucial life-course event, should receive more attention by health and welfare services because nutritional health at this stage has life long effects on women, her offspring and the next generation. Further studies on physiological mechanisms should be complimented

with more investigations into the psychological, social and cultural processes which underpin excess gestational weight gain and weight retention. The support required should be specifically tailored to the needs of women from less-privileged backgrounds. New EU dietary and physical activity guidelines are needed on how best maternal and infant services can support disadvantaged mothers.

3.2.2 Infant and young child health

3.2.2.1 Socio-economic status

A study in UK showed that breast-fed infants were around 40% more likely to move up the social ladder as adults compared with those who were bottle fed. The authors suggest the findings might be explained by the potential benefits on brain development, which might then lead to better exam and job prospects and greater earning potential. Alternatively other social and economic factors associated with breast feeding may explain the findings.[210] An infant born into a low income family is at increased risk of developing obesity. As discussed earlier the association between obesity and low birthweight (LBW) (Figure 3-3 lifecourse) is well recognised[211] and more evidence is emerging about the increased risks if born with a high birthweight (HBW) (Figure 3-4 lifecourse). In addition infants are twice as likely to become obese adults if their parents, especially the mother, are obese.

3.2.2.2 Underlying physiological mechanisms

Low birthweight infant (Figure 3-3)

After birth, a low birthweight infant appears to try to compensate for its lack of growth in utero and may show more rapid growth in its early months than a baby of normal birthweight, and this growth pattern appears to put it at higher risk of developing abdominal obesity.[212] Epidemiological evidence suggests that impaired foetal growth followed by rapid catch-up in infancy is a strong predictor of obesity, hypertension, diabetes type 2, and CHD.[213] [214]

A LBW infant has an increased risk of being stunted (short for his or her age) and suboptimal growth patterns are found among poorer groups in affluent countries[215] such as the United Kingdom. Stunting increases the risk of obesity, and is associated with impaired cognitive development and reduced work capacity later in life. Stunting is also a sensitive measure of poverty. LBW girls are more likely to become stunted mothers, who in turn are at greater risk of producing LBW infants.[216] The effect of this programming can transmit between generations and tends to have a cumulative effect on the social gradient both within and between generations.

High birthweight infant (Figure 3-4)

As discussed earlier obese women have an increased risk of delivering a high birthweight (HBW) infant (>4000g).[217] [218] [219] The percentage of girl neonates with HBW (>4kg) have almost doubled in Denmark over thirty years from around 8% in seventies to almost 15% in 1998-2003 and in boy neonates from 13% to 22 % respectively. Moreover Danish school children had a 50% increased risk of being overweight if they were born with a birthweight between 4.0 and 4.5 kg compared with children with a birthweight between 3.0-3.5 kg.[220]

Dental Health

National oral health surveys have revealed very high level of dental decay in young children in many countries, with children from the most disadvantaged communities commonly demonstrating the highest level of decay. For example in Scotland[221] by the age of 3 years over 60% of young children living in deprived areas have dental disease. The problem starts at a very early age and requires a partnership between a range of professionals and parents to emphasise the importance of good dental health and healthy eating habits from early childhood. Dental caries affect one in ten of all 3-4 year olds in the UK and a higher likelihood of caries occurred in children given a sweetened comforter as babies. Findings in other countries also highlight that early childhood caries "is a serious public health problem in disadvantaged communities in industrialized countries".[222]

3.2.2.3 Impact of feeding practices

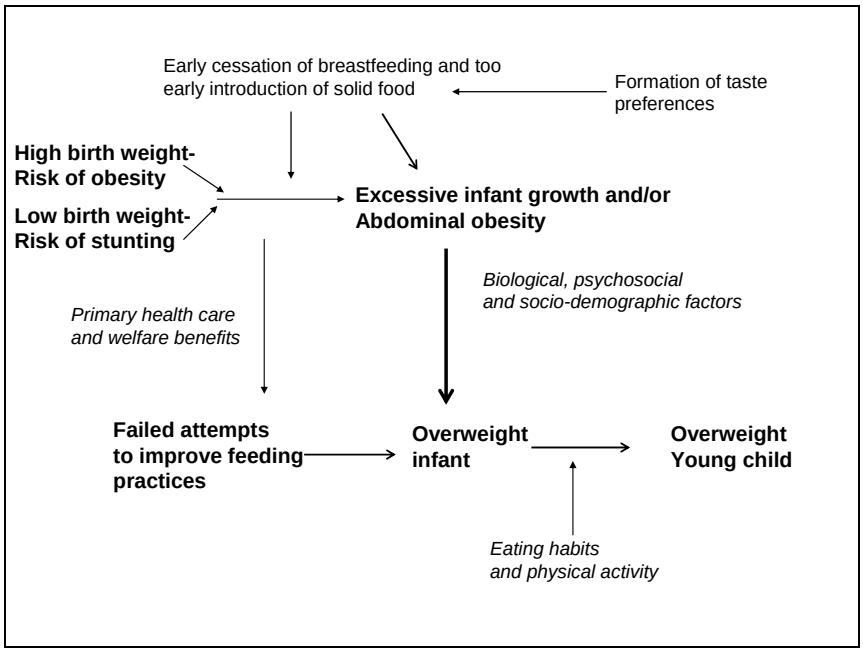
Evidence of the impact of infant feeding on growth has been reviewed extensively in many European countries. It appears that there is a dose-dependent association between longer duration of breastfeeding and decreased risk of overweight.[223] [224] [225] [226] [227] [228] Most systematic reviews[229] [230] [231] show that breast feeding compared with formula feeding is associated with a reduced risk of obesity. Similarly the WHO Multicentre Growth Reference Study[232] of 8,500 children in 6 countries shows that babies exclusively breastfed for six months are healthier and leaner than formula-fed babies. Both WHO (at its 2006 Ministerial Conference in Europe) and the Centre for Disease Control (CDC) in USA recommend breastfeeding as a key strategy for preventing childhood obesity and recommend to breastfeed (exclusively for 6 months) for at least one year.

The mechanisms underlying infant feeding practices and obesity

The mechanisms through which the effects of breastfeeding protect against subsequent obesity are not clear. For example the European Early Childhood Obesity Programme is testing the hypothesis that high early protein intake enhances the risk of later obesity in a randomized double blind intervention trial in 1150 infants in five European centres.[233] An infant will usually be fed infant formula if breastfeeding is not started or is discontinued early. Formula fed infants are often introduced to foods earlier than are their breastfed counterparts and they are exposed to different feeding patterns compared with breastfed infants.[234] In a study to determine the early determinants of childhood overweight, Bergmann et al[235] suggested that formula-feeding is predictive of obesity in later life because of a tendency to make feeds too concentrated and a tendency to encourage the infant to drink the full contents of the bottle.

Several studies show that the early introduction of food is associated with higher infant weight at one year.[236] [237] In Denmark infants of heavier women who were breastfed for shorter durations and received food early gained more weight (½kg) by 1 year than did infants of normal weight women.[238] It is possible that these infants had genetic characteristics that predisposed them to obesity[239] or alternatively they received more formula and semi-solid foods and thus more energy and protein, than did infants of normal weight women.[240]

Figure 3-8. Risks for infants of low-income mothers if not breastfed



The combination of short length of breastfeeding and too early introduction of food (Figure 3-8) appears to contribute to the increased risk of obesity in non-breastfed infants (both LBW and HBW). Although more work needs to be done, evidence strongly suggests that infant feeding practices represent an ideal window of opportunity for obesity prevention in childhood.

Taste development

One of the mechanisms whereby breastfeeding and infant feeding practices may help prevent childhood obesity could be via helping an infant to develop a taste and enjoy a wide variety of healthy fresh food. For example it is known that even in the foetus the sense of taste and smell is well developed in month six of pregnancy and that some tastes from the mother's food is transported to the foetus. Even when the foetus drinks it can experience some tastes from the food eaten by the mother.[241] Similarly it is believed that breast milk could influence the development of taste receptors.

In Denmark researchers measured the content of flavours in breast milk compared with infant formula. Breast milk contains small concentrations of a range of different flavours from the mother's diet whereas infant formula has a constant flavour. Infants who are not breast fed are therefore not used to the fact that food tastes different from meal to meal (Helene Hausner personal communication).

It has been shown that the first two years of life are important for taste development. A natural inherent preference for sweet and fatty tastes ensures that the newborn likes sweet and fatty flavoured breast milk. Similarly foods that taste sweet and fatty are rich in energy to ensure the brain gets the energy it needs. If infants get drinks with a high concentration of sugar it appears they learn to prefer this higher concentration. Infants do not have inherent preferences for other flavours and so need to learn to like foods with acid and bitter and other flavours. Studies have shown that infants who experience bitter flavours during the first year are more willing to eat vegetables and fruit compared with infants without this exposure.

Parents should be advised to give their children as many different fresh food taste experiences as possible within the first two years of life. It appears that up to about 2 years of life children do accept new flavours more easily and they do tend to like these foods years later. A taste preference may be established only after an infant or young child has been presented for a new taste after 8 to 10 times.[242] So it appears worthwhile to make sure a child experiences as wide a range of healthy fresh foods as possible from 6 months and during the first two years of life.

Conclusion on infant and young child health
Optimal infant feeding practices protect infants from an increased risk of obesity. It is therefore very important that infants are breastfed (exclusively for the 1st six months) and that parents give their children as many different taste experiences as possible within the first two years of life. Considering that it is the low income mothers who breastfeed least and are at higher risk of giving birth to infants with unhealthy birthweight (either too low or too high) recommendations for appropriate interventions via maternal and child services are required and these are discussed elsewhere.

3.2.3 Child and adolescent health

Socio-economic status
A UK study of 74,500 preschool children (3-4 years) showed the co-existence between food and nutrition insecurity and social inequalities which manifested itself as either underweight or overweight.[243] Both under-nutrition (3.3%) and obesity (8.5%) significantly exceeded the UK reference data. The cumulative prevalence of under-nutrition and obesity in the most deprived groups was 9.5% compared with 6.9% in the least deprived group. The conclusion was that both under-nutrition and obesity was significantly more common than expected in young children and strongly associated with social deprivation. Similar work carried out by Nelson[244] concluded that poor children suffer from food and nutrition insecurity which manifests as an unhealthy body weight (either high or low). A systematic review in 1999 noted that poverty, psychosocial deprivation and membership of ethnic groups constituted risk factors for obesity in school children.[245] In many European countries children and young people from disadvantaged backgrounds are disproportionately affected by obesity.[246] In turn, obesity and overweight in children and adolescents may interfere with their normal development.[247]

Food and nutrition security also manifests itself through: poor growth, reduced immune status, poor cognitive function, reduced learning ability and poor educational outcomes; factors which are detrimental not only to the individual and the surrounding family but which are costly to society in terms of health and social support and in lost economic productivity.

In addition, new evidence shows that lower IQ scores are associated with a higher prevalence of risk factors (obesity, overweight, reduced height, smoking initiation and heavy drinking).[248] The skills captured by IQ scores, such as verbal comprehension and reasoning, are likely to be important in the successful management of health behaviours, such as eating and physical activity patterns, as well as achieving better educational attainment at school.

School performance

Obese adolescents tend to have worse school performance, fewer academic qualifications and lower college acceptance rates than their normal weight peers with similar achievement scores (table 3-6). Socio-economic factors can independently affect both academic achievement and obesity.[249] [250] Sargent & Blanchflower (table 3-6) reported that British women, but not men, who had been obese at 16 years in 1974, earned 7.4% less than their non-obese peers at age 23. This was confirmed in a study where women (but not men), with obesity persisting from childhood, were less likely to be employed and to have a partner than women who were not obese.[251] It has been suggested that obesity may be both a marker of low academic performance and a cause of this poor performance.[252]

Table 3-6. European studies addressing obesity and student school performance

Citation	Research design	Outcomes related to school performance
Laitinen et al 2002 (Finland)[253]	Longitudinal study of approximately 10,000 subjects; measurements were taken at ages birth, 1, 14 and 16 years. School grades from national registers; BMI.	Obesity at age 14 years was associated with a low school performance at 16 years and a low level of education persisting until at least age 31.
Mikkila et al 2003 (Finland)[254]	Written survey of over 60,000 Finnish adolescents, aged 14-16 years. Obesity defined as >120% of sex/height specific mean weight for age.	Good school performance was inversely associated with being obese for both boys and girls.
Sargent & Blanchflower 1994 (UK)[255]	A birth cohort of over 12,500 respondents at age 23 years (National Study of all born on March 3-9 1958 in England/Scotland); survey; height and weights measured; obesity, BMI>95%.	Men and women who had been obese at age 16 had significantly fewer years of schooling. Obese women performed poorer on math and reading tests at ages 7, 11 and 16; no similar associations for males.
Sigfusdottir et al 2007 (Iceland)[256]	Cross-sectional survey data from 5810 Icelandic school children to explore the relationship between selected health behaviours and academic achievement.	Body mass index, diet and physical activity explained up to 24% ($P < 0.01$) of the variance in academic achievement when controlling for gender, parental education, family structure and absenteeism. Variance explained increases to 27% when depressed mood ($P < 0.05$) and self-esteem ($P < 0.01$) are added to the model, but confounds the role of physical activity.

Source: Adapted from Taras & Potts-Datema 2005[257] and Sigfusdottir et al 2007[258]

The Health Behaviour in School Aged Children (HBSC) study[259] found that low income children (aged 11, 13 and 15) throughout Europe are typically more exposed to unhealthy home and community environments, decreased access to quality education and health services, and a higher probability of a clustering of transgenerational health problems and unhealthy behaviours. The study suggests that these negative health influences contribute to the social gradient in obesity, and that the gradient is reinforced by difficulty in accessing or affording the healthiest food choices and opportunities for physical activity.

3.2.3.1 Underlying physiological mechanisms

The risk of a child in a low income household becoming overweight appears to increase with parental overweight and obesity.[260] Taking parental obesity into account increased the predictive power and those who were obese at 1-2 years of age had only an 8% likelihood of becoming an obese adult without obese parents, compared with a 79% likelihood for those aged 10 to 14 years with at least one obese parent.[261] The parent-child obesity relationship may be stronger between mothers compared with fathers, and the mother-child correlation appears to strengthen as the child gets older.[262]

Jackson and Wooton report that tracking of BMI-for-age across the lifespan is relatively strong during childhood into adulthood.[263] Similarly Whittaker et al[264] examined the probability of obesity in 25 year-old adults in relation to overweight or obesity at different ages during childhood. Seventy-five percent of overweight 10-15 year-old children and 80% of obese 10-15 year-old children were obese as young adults (compared to only 10% of those with a normal weight at childhood). The predictive power was less in younger children, and the proportion of overweight younger children who were obese as a young adult increased from 17% at birth, to 26% at 1-3 years of age, to 52% between 3-6 years of age, and as high as 69% between 6 and 10 years of age.

Young infants gain a high percentage of body fat but the rate of fat deposition slows from around the age of weaning onwards. The body mass index shows an initial fall during the second to fifth year of life and then a second increase that occurs between age five and seven, termed 'adiposity rebound', through adolescence and most of adulthood.[265] Several studies have shown that with an earlier adiposity rebound there is a greater risk of subsequent obesity and diabetes.[266] [267]

Medical health

Adolescent obesity may have a direct effect on adult morbidity and mortality, independently of later adult weight status.[268] Adolescence is thus one of the most vulnerable periods of the life course for the development of overweight and obesity.[269] The co-morbidities of obesity include: childhood-onset type 2 diabetes; increased risk of high blood pressure, coronary heart disease, stroke, and a range of cancers; pulmonary disease (e.g. sleep apnoea, asthma), orthopaedic problems (e.g. increased risk of fractures), neurological disorders, and gastroenterological disorders (e.g. non-alcoholic fatty liver).[270] [271] [272] During the early pubertal period, growth is associated with significant changes in body composition: weight gain occurs in boys and girls early in adolescence, but then ceases and even reverses temporarily in boys[273], but continues throughout adolescence in girls. Menarche in girls usually occurs shortly after the peak in height velocity and as height velocity decelerates, fat gain accelerates.[274]

Dental health

Given the importance of healthy teeth in the ability to eat nutritious foods such as fruits and vegetables, it is of concern that dental caries is common in 12 year olds in many regions of Europe.[275] An extensive review of the prevalence and severity of dental caries in Europe[276] reported that in most countries at least 65% of children had experienced dental caries in their permanent teeth, and that although the average number of decayed, missing or filled teeth (DMFT) was below 3.0 per child in many countries (meeting the WHO target) there were nine countries with higher averages, such as Latvia with a DMFT score of 7.7.

3.2.3.2 Food and beverages

Official surveys of nutritional status of children in UK show that many children are consuming sufficient energy but insufficient essential nutrients. For example between one half and two thirds of all children were found to be getting less than the official daily adequate intake of vitamin A. Similarly 70% of children consumed less that the recommended reference nutrient intake for B_1 and around 10% of children under 4 years and almost 50% of teenage girls in UK do not meet the recommended intakes for iron. Similar results were found for other important micro-nutrients, such as calcium.[277]

There is some evidence from well controlled trials that giving micro-nutrients to school children boosts their IQ. Ten out of 13 studies showed an increase in IQ in those children who were the most poorly nourished to start with.[278] Another study found that children who were given supplements of mainly fish oils (enriched with EPA, evening primrose oils and vitamin E) improved their reading progress three-fold and their spelling progress was two-fold compared with the control group.[279]

Vitamin and mineral supplements are not a long-term solution to poor nutrition. However, it should be recognised that obese children, especially those living in low income families, may be eating too much energy but at the same time have an insufficient intake of vitamins, minerals, anti-oxidants, phyto-chemicals and other essential nutrients.

Meal Patterns

Irregular meal patterns including snacks, usually high in added fat, salt and sugar, along with increases in standard portion sizes may contribute to weight gain in young people.[280] [281] Children and adolescents from low income families tend to eat less fresh fruit and vegetables and more sugar, fats, processed meats, bread, chips, baked beans, bakery products, sweets, salty snacks and soft drinks[282] [283] [284] [285] compared with those from higher social class households. Breakfast skipping appears to be associated with an increased risk of obesity. For example a Welsh study found that obese adolescents reported skipping breakfast twice as often as their normal-weight peers.[286]

3.2.3.3 Physical activity and sedentary behaviour

Sedentary lifestyle and its associated low energy expenditure is a known risk factor for obesity.[287] Trost et al studied 3-5 year-olds and found that overweight boys (though not girls) were significantly less active than their non-overweight peers during the preschool day. The authors concluded that a significant proportion of overweight toddlers and preschool children may be at increased risk for further weight gain because of low levels of physical activity during the preschool day.[288]

Various surveys have shown that children from SEGs tend to be less regularly active and more sedentary than those from higher SEGs.[289] [290] Children from lower SEGs report taking less exercise compared with those from higher SEGs[291], including less physical activity outside school.[292] [293] [294] Within the HBSC study it was found that vigorous physical activity was consistently lower among lower SEGs. Gender was also an important factor, with high-SES girls reporting lower levels of vigorous activity than low-SES boys, and low-SES girls being the least active overall.[295] Yet the evidence is not consistent and Thomas et al studied a group of secondary school students and found that the great majority, irrespective of SES, did not meet the recommendation of one hour per day moderate activity.[296]

Television viewing
A positive association between television viewing and physical inactivity and unhealthy food consumption appears to exist. Vereecken et al found that in the HBSC study children throughout Europe who watched more television were more likely to consume sweets and soft drinks and less likely to consume fruit and vegetables on a daily basis.[297] The links between television viewing and weight gain may also be affected by socio-economic factors. Young people from the lower socio-economic groups were likely to spend more time watching television compared with children from the higher income groups[298] and this correlates positively with obesity in low-income children.[299] This is possibly because TV viewing may be positively associated with physical inactivity combined with the consumption of sodas, crisps, cakes and pastries, and sweets and chocolates.[300]

3.2.3.4 Psychosocial factors

The psychological and social aspect of obesity is likely to be significant for young people, particularly for those from disadvantaged backgrounds.[301] Evidence suggests that poor behaviour and low self-esteem are related to low socio-economic status.

In schools, the early stigmatization of overweight children could explain lower self-esteem, greater shame and perceived teasing compared with their non-obese peers.[302] The most recent HBSC study found that young people from lower socio-economic groups were more likely to report poor psychological well-being, expressed as lower life satisfaction and more self-reported psychosomatic health complaints. These psychological problems were also found to be associated with overweight and obese young people showed significantly higher levels of psychological illness and psychosomatic complaints than their normal weight peers.[303]

Conclusion of child and adolescent health
Future interventions to prevent childhood obesity will have to consider more carefully the social gradient in obesity and possible links to nutrition insecurity. Just because a child is obese it does not mean that they have a sufficient intake of vitamins, minerals, antioxidants, phyto-chemicals and other essential nutrients to enable their brain and body to function properly. As reported above surveys show that children, living in low income families, eat diets that are lacking in vegetables and fruit and consume foods containing far too much sugar, fat and salt. The health impact of obesity in childhood is extensive and contributes to the vicious cycle of health inequalities.

3.2.4 Adult health

Socio-economic status
Socio-economic inequalities play an important role in the development of adult obesity, as shown in section 2 and discussed extensively at the beginning of this section. The prevalence of obesity in adults is usually a measure of the accumulation of adipose tissue throughout the lifecourse where the socio-economic factors interact with the different life stages (Figures 3-3 and 3-4) over time. Actions of women are heavily influenced by SES: available money and time; skills about how to budget and prepare food; access to shops and availability of healthy food; social pressures and cultural norms within their families and society.[304] In addition lack of transport and the safety, or otherwise, of underprivileged neighbourhoods will influence physical activity patterns. Similar trends to those found in Western Europe are found in adult obesity[305] in Turkey, where obesity

prevalence was highest in illiterate people and lowest among those graduated from universities or colleges.

3.2.4.1 Underlying physiological mechanisms

Obesity is not simply a result of overindulgence in highly palatable foods or a lack of physical activity, but rather the interaction of a number of factors leading to energy imbalance – energy intake exceeding energy expenditure over a considerable period.[306] Though societal and cognitive factors influence the control of body weight to a certain extent, a series of physiological processes are primarily responsible for body weight regulation. It is thought that the body exerts a stronger defence against undernutrition and weight loss than it does against overconsumption and weight gain. There is increasing evidence of a range of signalling mechanisms within the intestine, the adipose tissue and brain, and perhaps within other tissues, that sense the inflow of dietary nutrients, their distribution and metabolism and/or storage. These physiological mechanisms are coordinated within the brain and lead to changes in eating, in physical activity and in body metabolism so that body energy stores are maintained. The hormone leptin, which is secreted by adipocytes in proportion to their triglyceride stores and binds with receptors in the hypothalamus, may contribute to possible regulatory signal systems that act that maintain the energy balance.

3.2.4.2 Food and beverages

Lower income European adults tend to consume more processed meat, fat and sugar and higher educated groups tend to consume more fruit and vegetables.[307] In Finland Roos et al[308] reported that men with a higher educational level had a lower energy intake and women with a higher income a lower intake of carbohydrates. Higher socio-economic groups consumed more vegetables and fruit and berries. This was confirmed across Europe in a 2000 review by Irala-Estevez et al[309] where the authors found that a higher SES and education was associated with a greater consumption of fruit and vegetables and that in general, an unhealthier dietary pattern could be seen among adults belonging to lower socio-economic levels in Europe.

Lopez-Azpiazu et al[310] analysed European surveys and found that that people in the lowest category of occupation tended to consume more fat and saturated fat than people in the highest category. A 2003 paper from Ireland found a higher consumption of foods high in fat by socially disadvantaged groups, compared with a healthier food intake in those achieving a higher education level.[311] Similar findings were echoed in Holland by Hulshof et al[312] where they found that obesity, skipping breakfast and a low intake of vegetables were more prevalent among low income people compared with respondents with a higher SES.

Alcohol

The relationship between alcohol consumption and obesity appears to vary, depending on the country and the different social groups. Frequency of alcohol consumption has been found to be associated with obesity in the United States and Sweden[313], but not in France or in some parts the United Kingdom.[314] Reviewing the literature about adiposity and alcohol intake, Hellerstedt et al[315] concluded that there is a tendency for drinkers to be less obese than non-drinkers but that "the data are not consistent across diverse populations in direction, strength, and gradation of association". For example Erem et al[316] found prevalence of obesity in subjects using alcohol in Turkey was higher than that of the subjects not using alcohol. Given the concern about the contribution of rising alcohol

consumption in relation to the level of obesity[317] additional monitoring of alcohol intakes by socio-economic group is needed in relation to the prevalence of obesity in adults.

Food eaten outside the home
Consumption of food outside the home is increasing and these meals, particularly fast foods, tend to have higher energy densities and portion sizes than foods consumed at home.[318] The implications of these findings are discussed later.

3.2.4.3 Physical activity, sedentary lifestyle, and living environment

As discussed above, only 50% and 40% of respondents respectively in the 2003 and 2006 Eurobarometer surveys get physical activity at work and the levels vary considerably between EU Member States. Men with less education get more physical activity at work compared with those with more education. However physical activity at work seems to be decreasing even in the lower SEGs.[319] [320] Therefore the main opportunities for increasing physical activity levels in the future are likely to come from leisure activities rather than from work-related physical activity.

Access to physical active facilities
Those with a lower SES may tend to be less physically active during their leisure time compared with higher SEGs because there may be an inequitable distribution of affordable physical activity-related facilities (for example schools, youth organizations, parks, etc), programs and opportunities to exercise.[321] It has also been suggested that individuals of higher SES have, in addition to having higher incomes, more leisure time, greater opportunity for pay-for-use recreational exercise, and more social pressure toward exercise.[322] Adults from higher SE groups may also have more positive attitudes about the benefits of exercise. Women of higher SES report much higher levels of exercise, possibly in some cases as a deliberate effort at weight control.[323] [324] A survey of adults living in six European countries showed that individuals who have a lower income and who are less physically active report that there are less community-based opportunities for physical activities in their environment[325] and as discussed earlier these results were confirmed by the Eurobarometer study published in 2006.

Several studies show that districts (communities and neighbourhoods) where poor people live are associated with obesity.[326] Using data from the Swedish Annual Level of Living Survey, Cubbin et al found that Swedish adults living in a neighbourhood with high deprivation had higher odds of physical inactivity and obesity compared with people living in a more advantaged neighbourhood.[327] The use of cars as well as the increase in total screen time (the time spent in front of the television, computers, video games and other media devices) has contributed to more sedentary lifestyles and concomitant risk of weight gain[328] [329] in lower SEGs.

Similarly in Turkey Erem et al[330] discuss sedentary behaviour and lack of physical activity among adults, particularly those who are low income. They suggest that this can be partly explained by the fact that Turkey has witnessed dramatic changes in lifestyle in the past two decades. Modern transportation (buses and cars) has become available on a large scale, and agriculture has become largely mechanized. Also, women have no tradition of participating in sporting activities, and physical activity is restricted to housework. Traditionally, Turks consider obesity to be a sign of good health and beauty, an attitude that may contribute to the higher prevalence of obesity among ethnic minorities living in EU and Nordic countries.

3.2.4.4 Psychosocial factors

Stigmatisation and discrimination of obese adults, especially women, are frequent in many societies.[331] In the workplace, hiring prejudice and wage penalties have been reported[332], as well as less opportunity for health benefits (e.g. workplace health insurance). Some researchers have also proposed that the negative relationship between wages and body weight observed in some studies could be explained by the fact that a higher body weight could lead to reduced productivity (due to increased obesity-related health problems) or employers' weight-related discrimination, and thus to lower wages.[333] [334] [335] In the health care setting, negative attitudes and relatively more severe assessments on an obese patient's psychological functioning (compared with normal weight patients) have been reported. It has also been suggested that weight discrimination, especially against women, exists with regard to housing opportunities and relationships.[336]

Conclusions on adult health

Adults from lower socio-economic groups tend to be less physically active and more sedentary than those with a higher socio-economic status. Lower income European adults tend to consume more processed meat, fat and sugar and higher educated groups tend to consume more fruit and vegetables. Consumption of food outside the home is increasing and these meals, particularly fast foods, tend to have higher energy densities and portion sizes than foods consumed at home. In most countries low income women seem more vulnerable than men to developing obesity possibly because they are subjected to different environmental pressures via the life course: less physically active; pregnancy; Stigmatisation and discrimination especially regarding employment; responsible for managing the household budget and organising meals; and subject to pressure from mass media, marketing and societal norms.

3.2.5 Older peoples' health

Socio-economic status

The factors that are important for the health and wellbeing of low income older people include increased social support and more effective health care, as well as support to ensure access to physical activity and a healthy diet.[337] [338] This need for social support will increase in the future because of the ageing population in Europe. Within the EU Health Strategy the themes include *Fostering Good Health in an Ageing Europe*, which recognises that by 2050 the number of people in the EU aged 65+ will grow by 70% and the 80+ age group will grow by 170%. This means that the overall disease burden can be expected to rise. The risk factors for poor nutritional status among older people are similar to those described in Figure 3-2, but the combined impact can be more severe due to the ageing process.[339]

Ageing is associated with an increased prevalence of non-communicable diseases (e.g. cardiovascular diseases, type 2 diabetes, hypertension, knee osteoarthritis) and cognitive and functional disability, and dependency on external help.[340] [341] The impact of disability and functional limitations is important from both a social and a public health point of view.[342] Evidence from the USA suggest that a BMI between 18 and 28 in old women is associated with the least disability[343] and high rates of disability are reported at higher BMI indices. Older people on a pension are at risk of having a low income and this income inadequacy may be one of the most important environmental determinants of inadequate nutrition security among older people. Several of the health problems and

bodily changes experienced by older people have long been attributed to the normal ageing process but are increasingly being linked to lifestyle, socio-economic or environmental factors.

3.2.5.1 Underlying physiological mechanisms

After the age of 60 years, body weight on average tends to decrease. The contribution of fat mass to this weight loss is relatively small, but fat tends to be redistributed with advancing age toward more abdominal fat.[344] The reason for this redistribution is not really known, but declining testosterone and growth hormone levels in combination with declining rates of lipolysis of fat with aging[345] may play a role in men.[346] In women the declining oestrogen levels after menopause may be a critical factor.[347] [348] Abdominal obesity in particular increases with advancing age and is associated with an increased risk of insulin resistance, hypertension, dyslipidaemia, cardiovascular disease, lower levels of physical activity and generally poorer health status.[349] Overweight in older people also predisposes to symptoms of rheumatism or arthritis.[350]

There are important issues related to anthropometric measurement in older people and BMI may not be the best indicator of body fatness because of potential loss of muscle mass .[351] Waist circumference has been recommended as a better indicator of abdominal and overall fatness compared with BMI. Waist-hip ratio in the elderly may be difficult to interpret because, whereas the waist measures abdominal fatness, hip circumference may reflect variation in pelvic width and gluteal muscle.[352]

The biological effect of low SES on ageing is not clearly understood. Several studies[353] [354] show the rate of destruction of white-blood-cells (possibly a biological indicator of human aging) for its association to SES. It was found that low SES, in addition to the harmful effects of obesity and lack of exercise, appears to have a negative impact on white blood cell destruction.

Dental health

In older people, oral health status is especially important since it influences the ability to eat fresh fruit and vegetables and so nutritional status. Dental caries may accelerate with old age because the root surfaces of the teeth are exposed. In addition the salivary flow, which has a beneficial buffering effect against acids, is decreased and so the incidence of caries is likely to increase.[355] Periodontal disease also increases with age. Wearing dentures may alter food choices, which may result in lower intakes for key nutrients such as, anti-oxidants, iron and fibre. Older people without teeth consume fewer fruits and vegetables and more saturated fat and energy than those who retain their teeth. As a result older people without teeth are at increased risk of becoming obese and are more vulnerable to eating a less healthy diet because of disability and medical or dental conditions.

3.2.5.2 Food and beverages

The nutritional requirements for older people are similar to those of younger people, but they generally require less energy. As discussed above changes in diet owing to functional oral health problems such as tooth loss and mastication problems could contribute to the increased risk of disease and poor nutrition in older people.[356] [357] However it is thought that older people most at risk are those who lack access to food (food and nutrition insecurity) because of poverty or because of a disability.[358] The social aspects of meals are important and food variety has been shown to improve in older people when they are in

the company of others.[359] Food variety is positively correlated with nutritional quality and is associated with better health outcomes.[360 361]

Shopping
Differences in dietary habits of older people may be determined by access to shops.[362] Because of inappropriate public transport, older people may have difficulties in getting even to the nearest food shops. A recent survey in Dublin illustrated the difficulties, including choice and built environment, faced by older people in accessing food shops.[363] Respondents reported their concern about the lack of choice and the lack of appropriate and affordable portion sizes. The possibility of getting food delivered or the logistics of how to carry food home was also a concern along with the increased dependency on others to help with shopping.

3.2.5.3 Physical activity, sedentary lifestyle and the built environment

A higher level of physical activity has been associated with increased survival, a delay in the progression of disability and loss of functional ability, improved balance and strength, reduced incidence of falls (and hence risk of fractures) as well as higher quality of life in older people.[364 365 366] Physical activity improves glucose tolerance, and insulin sensitivity appears to be improved through non-vigorous as well as vigorous exercise among older people.[367 368] High body fatness in older people over 65 years has been found to be an independent risk factor in predicting mobility-related disabilities.[369] A Dublin survey[370] found that physical disabilities were also a problem: sight, hearing and mobility problems created difficulties when standing in queues, reaching goods on shelves and reading labels. Transport issues and the inability to cross roads were also cited as impediments for older people to be more physically active.

Fogelholm et al[371] examined how living in different communities may be related to physical inactivity in older people. The urban dwellers appeared to have better access to places for physical exercise (e.g. swimming pool, gym) compared with those living in rural settings and this was confirmed in other studies.[372 373] As a result older people living in urban environments may be in better health because they can be more active which, in turn, improves their ability to function and improve their access to health and social services.

3.2.5.4 Psychosocial factors

In older people psychosocial factors will be closely interrelated with other risk factors, particularly isolation and poverty.[374] One study found that stress associated with the feeling of not being able to fulfil the demands of everyday life was a strong predictor of obesity in women.[375]

Conclusion on older peoples´ health
The issue of healthy ageing, *Fostering Good Health in an Ageing Europe,* is a major theme within the EU Health Strategy given the expected increase in the proportion of older people projected (around one third of the population in some countries) over the next 20 years. A European study highlighted the interaction between a good diet physical activity in combination with non-smoking in a group aged 70-75 years of age. Men and women with three unhealthy types of behaviour had a three to four-fold increase in mortality. The study also showed that healthy behaviours in older age are not only related to a higher chance of survival but also to a delay in the deterioration of health status.[376] Ideal healthy ageing is a situation in which people survive to an advanced age with their

vigour and functional independence maintained and with morbidity and mortality compressed into a relatively short period before death.

3.2.6 Marginalised populations

There have been remarkably few studies in Europe that focus on the dietary habits among socially marginalised groups. Due to the sampling methods and response rates in nationally representative studies the marginalised are strongly under-represented in most population health surveys. Socially vulnerable people are unwilling to participate in surveys or respond to questionnaires. As a result there is a lack of information about their health habits, morbidity and general health condition or how these marginalised groups compare with the general population. It is very likely that the socially vulnerable have riskier health behaviour, poorer health and a higher morbidity than even the worst results found in population surveys.

Diet and physical activity

Small scale studies from European countries show that the nutritional status among socially vulnerable groups is characterized by vitamin deficiency and an unhealthy diet.[377] A series of reports in the UK have highlighted the difficulties of obtaining a healthy diet for families living on a low income[378], for homeless people[379], children and young adults living in poverty or leaving care homes[380], single parent families[381] and showing how dietary quality is linked to access and affordability issues.[382]

Dietary habits and nutritional status appear not to have been investigated among marginalised groups in many other countries but in France the homeless were interviewed about their eating habits.[383] This study showed that the alcohol intake among men and women was 30% and 17% respectively of their total energy intake. Drug addicts have poor eating habits which result in lower body weight and increased mortality.[384] A study from the USA carried out among 52 homeless women >50 years, showed that the most of their food was high in saturated fat and carbohydrates.[385]

In a survey in Copenhagen, almost 38% of the socially disadvantaged responded that they had difficulties to be physically active as they would like to be. “Tour de Udsat” (Tour for the Vulnerable) was a cycle run that was planned using tandems and 130 earlier and current drug addicts and alcoholics participated in the cycle run. Many participants increased their weight (there was free food) but there was no evaluation of health status before or after the intervention.[386]

Other reports from Denmark[387 388] include analyses of health and health behaviour among the most socially disadvantaged compared with the general population. One study of food purchasing habits showed that barely half of the 122 male users of drop-in centres for homeless people in Copenhagen could afford to buy food daily. Another study built on data from different Danish Health Surveys and showed that those that are most physically inactive are the socially disadvantaged and mentally afflicted (30%) compared with the general population (10%).

The Danish report[389] also shows that the percentage of people that eat salad or vegetables daily is lowest among those with an alcohol problem and those with poor social network (16%) compared with 21% in the general population. The percentage who eat fruit every day is least (34%) among the socially disadvantaged and those with an alcohol problem (34%) compared with 51% in the general population. The highest percentage with obesity is the socially disadvantaged (25%), especially in women (28%), compared with 11% in

the general population. The socially disadvantaged are also those most likely to develop diabetes type 2.

Medical health
The results stemming from the Danish study indicate that the socially marginalised groups in Denmark appear to have the worst health behaviours, which increase their risk of obesity and chronic ill health. There appears to be very few studies that investigate the link between physical activity and health in marginalised groups despite the fact that many studies show that there is a positive effect of physical activity on health. In addition this group seldom seek medical advice from their GP regarding obesity related illness, such as high blood pressure or diabetes compared with the general population.[390]

Conclusion on marginalised groups
Nationally representative health surveys are likely to under-represent the marginalized groups in society. There is therefore a need for nationwide health surveys among the socially marginalised people. Such a survey is being carried out in Denmark. The results will provide for the first time an overall picture of the health and determinants of health, including diet, physical activity and weight, among the Danish socially marginalised groups.

3.2.7 Ethnic minorities

Several studies show that dietary changes following migration to a more affluent area expose immigrants to an increased risk for diet-related chronic diseases including obesity.[391] [392] Migration often brings about fundamental changes in what people eat, forcing traditional customs to be adapted to new lifestyles.[393] For example Vietnamese women in the UK report lacking the confidence needed to initiate breastfeeding when they live in communities with few other Vietnamese women.[394]

Medical health
Refugee populations, seeking asylum in Europe, exhibit worse health behaviour and outcomes than resident populations. A study of Bosnian female refugees to Sweden in 1999 found that women (42-59 yr) had substantially higher levels of BMI and waist circumference[395] and these results are supported by a more recent report from Sweden.[396] The use of the standard definition of adult obesity, BMI $\geq$ 30, may lead to an underestimation of the risk of obesity-related diseases among ethnic groups. In particular Asian populations show equivalent levels of disease risk at an average BMI of 27-28, compared with $\geq$30 in western populations.[397] [398] Moreover some minority groups believe that high levels of body fat are desirable and attractive.[399] [400] This may explain the higher rates, described earlier, of ethnic groups living in Europe.

Dental health
Dental caries, as an indicator of poor diets and poor health behaviour, is more prevalent among children in immigrant groups in Europe compared with resident groups. Whereas dental disease levels are decreasing in the latter, it is increasing, particularly among pre-school children, in the immigrants. There are more than 20 million immigrants and refugees in Europe. They carry a serious dental disease burden in addition to their other problems. The higher caries levels of Asians and other immigrant groups has been attributed to a higher intake of sugar containing drinks and a higher frequency of consumption of sugary products .[401]

Diet

A study to monitor the dietary intake of energy, macro- and micronutrients in asylum seeker children in the Netherlands found that their dietary intake generally contained too much fat and insufficient amounts of micronutrients.[402] The authors found that analyses of the growth of these children showed that the mean weight for height had increased during their stay in The Netherlands. The authors explained this by citing several factors, including dietary risks before migration, cultural believes, lack of knowledge of food composition, food price and nutrition transition. Maintaining a healthy diet also proves difficult for the Traveller community mainly due to low levels of income and constrained physical access to cooking and storage facilities. Romany children in the Czech Republic consumed far less fruit, vegetables and milk products and over four times more high-fat and high sugar snack foods than their Czech counterparts[403] and these children also have higher rates of obesity.[404]

Physical activity

Table 3-7 shows physical activity and overweight (including obesity) among immigrant groups living in Sweden compared to the reference group born in Sweden: non-OECD groups show significantly less physical activity levels and greater obesity prevalence of obesity.

Table 3-7. Prevalence (%) of regular physical activity and overweight (including obesity) in immigrant men and women compared with those born in Sweden

Country of origin	Regular physical activity		BMI ≥ 25	
	Men	Women	Men	women
Sweden	54	59	52	32
OECD countries	49	59	45	30
Finland	43*	58	59	37
Southern Europe	49	35*	64*	55*
Eastern Europe	55	37*	54	36
Poland	44*	44*	56	27
Turkey	28*	20*	50	56*
Iran	43*	32*	45	40*
Chile	46*	34*	56	53*
Other countries	39*	42*	48	39*

Adapted from Daryani 2006[405], based on a Survey of living conditions for 1996-1999 (ULF).
* significant difference P≤ 0.05 between immigrants and reference group (Sweden).

Psychosocial and cultural factors

Psychosocial and cultural factors are likely to have an impact when refugees are often settled in socially deprived residential areas.[406] Such areas are often characterised by high mobility, making social cohesion, a lasting sense of community and a support system difficult to obtain. Refugee populations are less likely to have access to leisure time activities and employment opportunities and are more often discriminated against in health care settings.[407] Resettlement policies in several EU countries originally aimed at achieving faster integration into "mainstream" society have inadvertently brought on additional isolation to these populations, and have been highly detrimental to the mental health and social integration potential of newcomers.[408]

Conclusion on ethnic minorities

There is remarkably little epidemiological data available on the obesity prevalence within the socially marginalised and ethnic minorities in European countries, making the distinction between socio-economic effects on obesity and ethnic effects on obesity

difficult to disentangle. Table 3-8 below shows how the key obesity determinants, described in Figure 3-2, can be used to investigate some of the key determinants of obesity in ethnic minorities.

Table 3-8. Key determinants of the social gradient in obesity in ethnic minorities

Key determinants	Example of possible interaction between determinants
Socio-economic status	The pattern of working, including likelihood of employment, the hours worked and the type of occupations may be substantially different between ethnic groups
	Members of an ethnic group may earn less than the average and women especially may have low educational attainment
Medical health	Members of an ethnic group may be treated differently from the expected standard by health care professionals
Dental health	Higher consumption of sugar containing drinks
Food and Beverages	Infant feeding patterns may include too early introduction of semi-solid food and teas. Some ethnic groups may be forced to change their traditional eating patterns.
Physical activity	Women may not be allowed to participate in group physical activity where men are also present
Sedentary	A high level of use of television in ethnic children
Psychological and cultural factors	Members of ethnic groups may suffer from discrimination, stigmatisation and social isolation within other cultures. Obesity may be seen as a status symbol within some ethnic groups.

Source: Adapted from Bhopal 2007[409]

Lower SES may be sufficient to explain the variation between the general population and the minority groups. However other factors such as the degree to which different food cultures and physical activity patterns influence weight gain within marginalised populations and ethnic minorities needs to be investigated.

4 Interventions to reduce inequalities in obesity

This section reviews current evidence on interventions for the prevention of adult and childhood obesity with reference to inequalities – including those interventions that have targeted specific SEGs or which have analysed their effects using SEG as a controlled variable. The section also examines available evidence for general interventions targeting obesity prevention and its immediate determinants, such as dietary patterns and physical activity level, which could have a beneficial effect on SEG. Subsequently we consider specific interventions which target vulnerable groups at critical stages of the life course.

Main findings

- Very few controlled interventions have targeted lower socio-economic groups or have examined the effect of the intervention on different socio-economic groups.
- Where evidence is available, it shows that participants from lower income groups are likely to show less response to health promotion programmes and have higher drop-out rates.
- Interventions in the community are often of short duration and can fail to take sufficient account of ethnic and social diversity.
- Educational information alone is relatively ineffective among lower income groups and may increase inequalities.
- There is evidence that breastfeeding support programmes can be effective for women in low income groups.
- Interventions that engage lower income groups can be offered through health care and social support services at various stages in the life course and these may have a beneficial impact on reducing the social gradient in obesity. However better evaluations of these interventions are needed.

4.1 Available evidence

In order to answer the question of which interventions are effective for reducing the social gradient in obesity we examined the following types of evidence:

- Systematic reviews of controlled interventions and other interventions;
- National evidence-based guidelines for reducing obesity.
- The Medline database 1997-2007 using search terms 'obesity', 'prevention' or 'intervention' and 'inequality' or 'socio-economic', considering papers primarily of European origin;

4.1.1 Systematic reviews

This section provides a review-of-reviews concerning obesity prevention, diet and physical activity. The papers examined reveal a remarkable paucity of evidence for effective interventions to prevent obesity in any section of the population, not just those in lower SEGs. Nearly 80 evidence reviews have been conducted in the period 2000-2007 and most accept that only small changes in obesity prevalence or in dietary or physical activity behaviour are likely to be found in the best of circumstances. A minority of the reviews made recommendations concerning inequalities or SEG-related effects (see table below). Of the reviews that do consider such effects, the main conclusions are:

- Only a few health promotion programmes take sufficient account of individual, ethnic, cultural and social diversity.

- Participants from lower income groups are likely to show less response to a health promotion programme and have higher drop-out rates.
- Leaflets and educational information alone is relatively ineffective among lower income groups and may increase inequalities.
- Breastfeeding support programmes can be effective for women in low income groups.

Table 4-1. Summary of SES-related recommendations in major reviews of evidence on obesity prevention and related interventions

Review	***Recommendations specific to SEGs***
Interventions to prevent weight gain, a systematic review of psychological models and behaviour change methods. Hardeman et al, 2000. [410]	Smaller effects were found among low-income participants. Participation dropout was higher among lower-income subjects.
Consolidation and updating the evidence base for the promotion of breastfeeding. Stockley, 2000.[411]	Information provision alone is not effective, and may exacerbate inequalities. There is a negative impact of returning to full-time work on duration of breastfeeding.
A systematic review to evaluate the effectiveness of interventions to promote the initiation of breastfeeding. Fairbank et al, 2000.[412]	Among women from different ethnic and low income groups, literature alone is not effective in promoting breastfeeding whereas group health education can be effective. Cash payments increase participation rates.
Toward Public Health Nutrition Strategies in the European Union to implement Food Based Dietary Guidelines and to enhance healthier lifestyles. Sjostrom et al, 2000.[413]	None
School-based interventions for primary prevention of cardiovascular disease: evidence of effects for minority populations. Meininger, 2000.[414]	None
The effectiveness of school-based interventions in promoting physical activity and fitness among children and youth, a systematic review. Dobbins et al, 2001.[415]	Age, gender and ethnicity may affect outcomes and require further study.
Improving health professionals' management and the organisation of care for overweight and obese people. EL Harvey et al, 2001. Cochrane Library.*	None
Preventing obesity in children and adolescents. Dietz et al, 2001.[416].	None
The importance of physical activity in the prevention of overweight and obesity in childhood: a review and an opinion. Steinbeck, 2001.[417]	None
Interventions for preventing obesity in childhood: a systematic review. Campbell et al, 2001.[418]	None
Extending breastfeeding duration through primary care: a systematic review of prenatal and postnatal interventions. de Oliveira et al, 2001.[419]	None
Environmental influences on eating and physical activity. French et al, 2001.[420]	None
Achieving physiological change in school-based intervention trials: what makes a preventive intervention successful? Lytle et al, 2002.[421]	Participants from diverse cultural backgrounds are rarely catered for in experimental design where 'one size fits all', compromising the ability to show effects.
Recommendations to increase physical activity in communities. Task Force on Community Preventive Services, 2002.[422]	Recommends enhanced access to places for physical activity plus informational outreach activities.
The effectiveness of school-based strategies for the prevention of obesity and for promoting physical activity and/or nutrition, the major modifiable risk factors for type 2 diabetes: A review of reviews. Micucci et al, 2002.[423]	Different age groups, ethnic groups and genders need different approaches.
Obesity - problems and interventions. Swedish Council on Technology Assessment in Health Care, 2002.[424]	New outreach strategies need to be developed.
The prevention and treatment of childhood obesity. Centre for Reviews and Dissemination, 2002.[425]	None
The effectiveness of interventions to increase physical activity, a systematic review. Kahn et al, 2002.[426]	None
Follow up exercise studies in paediatric obesity: implications for long term effectiveness. Maziekas et al, 2003.[427]	None
Interventions for treating obesity in children. Summerbell et al, 2003. Cochrane Library.*	None
Obesity - problems and interventions. Swedish Council on Technology Assessment in Health Care, 2002.[428]	None
Advice on low-fat diets for obesity. S Pirozzo et al, 2002. Cochrane Library.*	None
Exercise for obesity . K Shaw et al, 2002 – in process. Cochrane Library.*	None
Obesity, diagnosis, prevention, and treatment, evidence based answers to common questions. Reilly et al, 2002.[429]	None

Prevention of obesity. Schmitz et al, 2002.[430]	None
The effectiveness of interventions to increase physical activity: a systematic review. Kahn et al, 2002.[431]	None
Prevention of obesity – is it possible? Muller et al, 2003.[432]	Health promotion, counselling, better school education and social support are promising strategies.
The effectiveness of public health interventions to promote the initiation of breastfeeding: Evidence briefing L Protheroe et al, 2003. [433] (Based in large part on Fairbank et al 2000 – see above.)	Women from different ethnic and SES groups respond poorly to literature but better to group health education.
Physical activity interventions in the prevention and treatment of paediatric obesity: systematic review and critical appraisal. Reilly et al, 2003.[434]	None
Management of obesity and overweight: Evidence briefing. Mulvihill et al, 2003.[435]	None
Family involvement in weight control, weight maintenance and weight-loss interventions: a systematic review. McLean et al, 2003.[436]	None
Promoting walking and cycling as an alternative to using cars: systematic review. Ogilvie, 2004.[437]	Inadequate evidence for the social distribution of effects and the potential for widening social inequalities in health.
Increasing activity to reduce obesity in adolescent girls: a research review. Clemmens et al, 2004.[438]	None
Exercise prescription for the prevention of obesity in adolescents. Carrel et al, 2004.[439]	None
The effectiveness of physical activity interventions for the treatment of overweight and obesity and type 2 diabetes. Miller et al, 2004.[440]	None
Interventions for promoting physical activity. Hillsdon et al, 2004. Cochrane Library.*	None
Addressing Childhood Obesity: The Evidence for Action. Casey et al, 2004.[441]	Research should be systematically reviewed to determine appropriate strategies for minority populations.
Cardiovascular health promotion in the schools. Hayman et al, 2004.[442]	Across well-controlled, well-conducted studies, differential results in outcome indicators point to the need for researchers to pay more attention to developmental age, gender, culture, and socio-demographic factors.
Review of children's healthy eating interventions. Worsley et al, 2004.[443]	None
Physical activity in the management of obesity. Hills et al, 2004.[444]	None
Initiating and maintaining physical activity for type 2 diabetes mellitus. Armour et al, 2004 – in process. Cochrane Library.*	None
Non-curricular approaches for increasing physical activity in youth: a review. Jago et al, 2004.[445]	None
The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews. Evidence briefing summary. Hillsdon et al, 2005.[446]	No evidence available on effectiveness of physical activity interventions in different social groups.
Interventions implemented through sporting organisations for increasing participation in sport. Jackson et al, 2005. Cochrane Library. *	Interventions funded and conducted in this area must be linked to a rigorous evaluation strategy in order to examine overall effectiveness, socio-demographic differentials in participation and cost-effectiveness of these strategies.
Interventions for promoting the initiation of breastfeeding. Dyson et al, 2005. Cochrane Library.*	Breastfeeding education increased initiation rates for low income women.
School- and family-based interventions to prevent overweight in children. Muller et al, 2005.[447]	Families of intermediate and high socio-economic status benefit more from interventions. There are social barriers limiting the success of family-based interventions.
Interventions for preventing obesity in children. Summerbell et al, Cochrane Library 2005.*	None
Psychological interventions for overweight or obesity Shaw et al, 2005. Cochrane Library.*	None
Public health strategies for preventing and controlling overweight and obesity in school and worksite settings. Katz et al, 2005.[448]	None
Physical activity and obesity prevention: a review of the current evidence. Wareham et al, 2005.[449]	None
Prevention of childhood obesity. Ells et al, 2005.[450]	None
Policy interventions through sporting organisations for promoting healthy behaviour change. Jackson et al, 2005. Cochrane Library.*	None
Physical activity and diabetes prevention. LaMonte et al, 2005.[451]	None
Preventing childhood obesity: Health in the balance. Koplan et al, 2005.[452]	None
Screening and interventions for childhood overweight: a summary of evidence	None

and recommendations statement. US Preventive Services Task Force, 2005.[453] [454]	
Do baby-friendly hospitals influence breastfeeding duration on a national level? Merten et al, 2005.[455]	None
Effectiveness of school programs in preventing childhood obesity: a multilevel comparison. Veugelers et al, 2005.[456]	None
Interventions for increasing fruit and vegetable consumption in pre-school children. Cockroft et al, Cochrane Library 2005.*	None
Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence and 'best practice'. Flynn et al, 2006.[457]	Few programmes address the needs of subgroups, e.g. immigrants new to developed countries.
Promotion of breastfeeding initiation and duration: evidence into practice briefing. Dyson et al, 2006.[458]	Population-wide and specified targeted actions are recommended for disadvantaged white women, particularly teenagers, first time mothers and lone parents.
Promotion of physical activity among adults: evidence into practice briefing. Cavill et al, 2006.[459]	Absence of evidence of effectiveness for physical activity interventions with disadvantaged groups must be considered carefully by managers, policy makers and commissioners of services. New physical activity projects may inadvertently increase SES health gradients if projects have a differential impact on social groups.
Food-support programmes for low-income and socially disadvantaged childbearing women in developed countries: Systematic review of the evidence. D'Souza et al, 2006.[460]	For low-income women, counselling and nutrient supplements may improve maternal health but not rates of low birthweight. Further evidence is needed on long-term effects of interventions.
Interventions that use the environment to promote physical activity. Evidence review. Foster et al, 2006.[461]	Evidence gap concerning disadvantaged groups.
Obesity: guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children. Section 3 – Prevention: evidence statements and reviews. NICE 2006.[462] e	There is a paucity of evidence on the effectiveness of interventions among lower socio-economic groups and minority groups.
Obesity prevention in schools. French et al, 2006[463]	None
The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes. Doak et al, 2006.[464]	None
An integrative research review: effective school-based childhood overweight interventions. Cole et al, 2006.[465]	None
Interventions to prevent obesity in children and adolescents: a systematic literature review. Flodmark et al, 2006.[466].	None
Obesity prevention: evidence statements and reviews. NICE, 2006.[467]	None
The role of schools in obesity prevention. Story et al, 2006.[468]	None
The role of child care settings in obesity prevention. Story et al, 2006.[469]	None
The role of parents in preventing childhood obesity. Lindsay et al. 2006.[470]	None
School-based interventions for child & adolescent obesity. Sharma, 2006.[471]	None
Effectiveness and challenges for promoting physical activity globally. Shilton et al, 2007.[472]	Remaining challenges include understanding effective practice in developing countries and in sub-populations with increased needs.
Interventions to promote walking. Ogilvie et al, 2007.[473]	Concern that targeted interventions may be preferentially taken-up by better off groups in the population.
International school-based interventions for preventing obesity in children. Sharma, 2007.[474]	None
Strategies for the prevention and control of obesity in the school setting: systematic review and meta-analysis. Katz et al, 2007.[475]	None
Preventing obesity in pre-school children: a literature review. Saunders, 2007.[476]	None

* Cochrane Library services are available at http://www.cochrane.org/index.htm

4.1.2 National evidence-based guidelines for reducing obesity.

In a further appraisal of interventions, we examined a selection of national and EU evidence-based recommendations and guidelines for obesity prevention to assess whether these guideline documents have specific recommendations for preventing obesity among lower SEGs. Table 4-2 summarises the findings.

Table 4-2: Recommendations on socio-economic groups contained in national practice guidelines[a]

National practice guidelines	SEG-specific guidance?
Europe – European Child Obesity Group, 2004. [477]	No
France - INSERM recommendations, 2000.[478]	No
Germany - Prevention and Treatment of Obesity. 2007.[479]	No
Scotland - Scottish Intercollegiate Guidelines Network. 2005.[480]	No
UK (England) – NICE guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children 2006.[481]	People from certain ethnic and socio-economic backgrounds may be at greater risk of obesity, and may have different beliefs about what is a healthy weight and different attitudes towards weight management. Advice needs to be tailored for different groups. This is particularly important for people from black and minority ethnic groups, vulnerable groups (such as those on low incomes) and people at life stages with increased risk for weight gain (such as during and after pregnancy, at the menopause or when stopping smoking). There is little UK-based evidence on the effectiveness of multi-component interventions among key at-risk groups (for example, young children and families and black and minority ethnic groups), vulnerable groups (for example, looked-after children and young people, lower-income groups and people with disabilities) and people at vulnerable life stages (for example, women during and after pregnancy and people stopping smoking).
UK (England) – NICE guidance on physical activity: brief interventions. 2006[482]	Service providers should focus, in particular, on whether or not opportunistic advice is helping to increase the physical activity levels of people from disadvantaged groups, including those with disabilities (and thereby tackling health inequalities). They should also assess how effective professionals from a range of disciplines are at raising long-term physical activity levels among these groups. Service providers should pay particular attention to the needs of hard to reach and disadvantaged communities, including minority ethnic groups, when developing service infrastructures to promote physical activity.
UK (England) – NICE guidance to improve the nutrition of pregnant and breastfeeding mothers and children in low-income households (early draft 2007)[483]	A wide range of population and targeted measures are given, including encouraging women to reduce their BMI to below 30 before becoming pregnant and/or after pregnancy, by informing them (as appropriate) about the risks and providing a structured programme of support. This programme should be tailored to the needs of an individual or group; should combine advice on healthy eating with regular, moderate physical activity (for example, brisk walking); should identify and address barriers to change; and should provide ongoing support over a sufficient period of time to allow for sustained lifestyle changes. Service providers should also advise breastfeeding women that losing weight through a combination of healthy eating and regular exercise will not affect the quantity or quality of their milk.
UK (England) – NICE guidance on promoting and creating built or natural environments that encourage and support physical activity (early draft 2007)[484]	Evidence gap: There is little evidence on the differential impact of interventions on different social groups.

[a] Note: a discussion of national policy documents and action plans is found later in the discussion of policies: this table deals only with specific guidelines aimed at relevant health professionals.

4.1.3 Medline review

In addition to considering the reviews and guidelines available, we also conducted an examination of the Medline database of scientific papers for the last decade (1997-2007) using the search terms 'obesity', 'prevention' or 'intervention' and 'inequality' or 'socio-economic'. The Medline search found over 700 papers, but of these fewer than 20 were directly relevant to the issue of interventions in the European context to prevent obesity in lower SEGs or which reported intervention effects in different SEGs. This lack of evidence is a major problem for policy-makers concerned with preventing obesity. There is a general paucity of well-run controlled trials to provide clear evidence for effective interventions against obesity in the population.[485 486 487 488 489]

Children

The most frequent form of intervention is among children of school age. Reviews of such interventions at school and in family and community settings, usually combining physical activity and dietary changes, have found that these approaches have achieved only small effects, typically recording improvements in body weight of less than one kilogram over a period of a year or more compared with non-intervention controls.[490]

A study conducted in Kiel on the prevention of obesity in children (the KOPS study) reviewed the very few controlled studies on prevention of overweight in children and adolescence and noted how these studies differ with respect to strategy, setting, duration, focus, variables of outcome and statistical power. Although home and school-based interventions show some improvement of health knowledge and health-related behaviours, they have only minor or no effects on body weight but may reduce the subsequent incidence of overweight.[491 492]

The KOPS study has found that the effects of interventions seem to be more pronounced in girls than in boys, and that children of middle and high SEGs benefit more from intervention than children in families with low socio-economic status or in single-parent families.[493] The KOPS study has suggested that there are significant social barriers limiting the success of such interventions, and that the development of effective preventive interventions will probably require strategies that affect multiple settings simultaneously. The authors suggest that national actions will be needed, and these may help to reinforce more localised initiatives.

A new intervention targeting adolescents in the Netherlands is underway during 2007.[494] This study, the NRG-DOiT intervention - *a comprehensive school-based weight gain prevention program, tailored to the needs of Dutch adolescents from low socio-economic background* - focuses on the reduction of the consumption of sugar-sweetened beverages, reduction of energy intake derived from snacks, decreased of levels of sedentary behaviour, and increased of levels of physical activity (i.e. active transport behaviour and sports participation). An educational program, covering 11 lessons of both biology and physical education classes is complemented by an environmental component encouraging and supporting changes at the school canteens, as well as offering additional physical education classes.

A major review of over 1300 formal and informal interventions on child obesity across the world (but mostly in North America and Europe) found that no single programme emerged as a model of best practice, and there was a particular shortage of interventions to address the particular needs of subgroups of children and youth.[495] The authors were particularly concerned at the lack of information available on obesity prevention

programmes for immigrants and ethnic minorities, and for pre-school children. Other gaps in knowledge identified in the review include a limited number of interventions in home and community settings and a lack of upstream population-based interventions.

More specifically-focussed interventions with low-income families are needed. One trial to examine the effects of interventions on subsequent obesity is being undertaken in New South Wales, and involves multiple home visits to disadvantaged households to encourage healthy feeding practices in children up to two years of age.[496]

Parents of overweight children may fail to recognize excess weight in their children (even though they know the actual body size[497]) and this may be related to their own overweight or lack of interest in maintaining high levels of health promoting behaviour,[498] and these factors may themselves be related to low socio-economic status.

Home visiting programs which provide social support to first time mothers have been established as effective interventions for improving the health and wellbeing of parents and children.[499] [500] [501] These programs have been widely promoted as a means of preventing a range of health and developmental problems in children from vulnerable and disadvantaged families, although it appears that none have addressed child obesity. Evaluations of infant intervention strategies highlight the need for programs such as home visiting to be a part of broader strategies for promoting healthy family functioning and social support.[502]

Adults

For adults, the EU-funded *Eurodiet* project reviewed dietary targets and intervention strategies needed to achieve better nutritional status for Europeans. The evidence review for interventions concluded *Reviews have been carried out on the health impact effectiveness of various types of intervention to promote healthy eating and physical activity in the population. These conclude that the most effective interventions a) adopt an integrated, multidisciplinary, and comprehensive approach b) involve a complementary range of actions, and c) work at an individual, community, environmental and policy level. Information provision in isolation is not effective, and may exacerbate inequalities in health. In some countries inequities in diet and physical activity are not only significant contributors to inequalities in health, but are increasing. Effective interventions to address inequities need to tackle the broader determinants of health, including social exclusion, social cohesion, environmental, and structural factors.*[503] The programme included a review of cost-effectiveness in the prevention of heart disease[504] which showed that dietary interventions on a population basis were likely to be more effective than individual treatment regimes, and this was particularly likely to be the case where the underlying prevalence was greatest – for example among lower SES populations.

In research related to factors that may be linked to obesity, studies of the use of nutrition labelling panels on food packages have shown that better educated shoppers are more likely to make use of the information displayed.[505] This should not lead to the conclusion that shoppers – usually women in the low income areas – simply need more nutrition education, because having nutrition knowledge has not been found sufficient to change eating habits relevant to the prevention of obesity.[506] [507] Furthermore, several studies among adults [508] [509] and children [510] [511] have shown that there is no association between nutrition knowledge and the risk of overweight.

Interventions to reduce obesity-related diseases

Few interventions to reduce obesity-related diseases in low-income households have been systematically undertaken with dietary and health outcomes reported.[512] Since low-income households tend to cluster geographically, a number of community-based programmes have been designed and implemented with the aim of reducing coronary risk factors. Examples can be given of such programmes in the UK, including 'Good Hearted Glasgow',[513] 'Have a Heart Paisley',[514] 'Heart Beat Wales' [515] and 'Action Health' [516] but these programmes rarely report specific results for low-income households and are not adequately powered to show subgroup analysis. In some cases the response rates for adults living in the most-deprived communities have been particularly low.

The Heart Beat Wales programme used a coordinated range of activities, including public education campaigns along with supportive policy and infrastructure change. The resources that were developed included a BBC television series, food labelling and nutrition education with a major grocery retailer and Heart Beat restaurant awards. However, outcome measures (including the use of butter, fruit, vegetables, chicken, low-fat milk, wholemeal bread, smoking, frequency of exercise and body weight) in intervention and reference areas did not differ and it was concluded that any changes in the outcome variables had been too small to be detected against the larger trends in lifestyle behaviour prevailing in Wales.

In Vienna, Austria, a work-place health promotion programme 'A Heart for Vienna' has noted the high levels of cardiovascular risk factors, including overweight, obesity and hypertension, and shown that these risk factors are more common among the lower income workforce: however, an awareness-raising intervention programme has not reported an evaluation to date..[517] In a treatment-oriented intervention among lower-income, older people in Naples, Italy, awareness of disease and response to treatment were poorer among less educated patients.[518]

Community interventions

Smaller intervention programmes specifically targeted at low-income groups in the UK include the Food Standards Agency 'Cookwell' trial, the aim of which was to develop a transferable-food-skills initiative that would increase consumption of fibre-rich starchy carbohydrates, fish, vegetables and fruit, and decrease consumption of fat in adults (including men) living in areas of deprivation. The intervention consisted of a 10-week programme of cooking skills classes in eight communities across Scotland, using a community development approach and informed by formative research with the target group.[519] The study had a quasi-experimental design with an intervention group and a delayed intervention group, and was evaluated quantitatively: pre- and post-intervention measures of budget, diet and body weight; a questionnaire-based cooking skills assessment. Of 93 participants, 50 completed food diaries at baseline and immediately post-intervention and 40 of these 50 completed a further food diary at 6 months post-intervention. There was an increase in fruit consumption in the intervention group (one extra portion of fruit per week) post-intervention, but this increase was not sustained after 6 months.[520]

One of the few trials that focused on low-income subjects[521] demonstrated that behavioural counselling could increase fruit and vegetable consumption more than nutritional counselling (by 1.5 servings/day compared with 0.9 servings/day respectively at 12 months from a baseline of 3.60 servings/day compared with. 3.67 servings/day). The subjects included men and women aged 18–70 years recruited from a primary health

centre in a deprived ethnically-mixed inner-city area in the UK who were randomly assigned to either behavioural or nutrition counselling. The interventions included two 15 min consultations 2 weeks apart that were tailored to the individual, with personalised specific advice and setting of long- and short-term goals. Recruitment of the target group was, however, challenging. It should also be noted that the baseline consumption levels for fruit and vegetables were higher than those expected among lower income groups (usually around 2.1 - 2.5 servings/d).[522]

Maternal age women

There have been very few evaluations undertaken on practical interventions aimed at improving access to healthy diets, improving food affordability and availability (e.g. practical food skills classes).[523] One study from University of Dundee evaluated the feasibility of a cooking skills programme led by midwives in a community setting for teenage pregnant women.[524] The programme incorporated seven informal food preparation sessions and opportunities for discussion of food and health matters (including food safety and well-being in pregnancy). Whilst the midwives found the package easy to follow and use, only sixteen (of the 120 invited) women attended the course and the authors concluded that alternative methods of delivering and evaluating such a package should be investigated. Further cooking skills interventions are currently being funded by the UK Food Standards Agency, including studies of dietary interventions aimed at improving the diets of girls and women at risk of having low-birth-weight babies.

A major focus of health interventions has been to promote breast-feeding amongst low-income women. The conclusions of a recent Cochrane review reports that the forms of breast-feeding interventions (health education, breast-feeding promotion packs, early infant–mother bonding) evaluated for systematic review were effective at increasing breast-feeding initiation rates among women on low incomes in the USA.[525] Seven trials involving 1388 women were included: five trials involving 582 US women on low incomes show that breast-feeding education has a significant effect on increasing initiation rates compared with routine care.

US programmes

The US Expanded Food and Nutrition Education Program is a federally-funded nutrition programme aimed at assisting low-income youth and families (with young children) and ethnic minorities to acquire practical food knowledge, skills, attitudes and behaviour change (including money management and getting the most from health assistance programmes) to help achieve better family diet. The programme is delivered by para-professionals and volunteers adopting a hands-on, 'learn by doing' approach. The programme has been shown to influence a range of food practices (including food budgeting, food safety and food preparation, and cost–benefit analysis suggests that for every US $1 invested in the programme, between US $2.48 (Tennessee) and US $10.64 (Virginia) in benefits from reduced healthcare costs can be expected.[526]

In the USA a trial specifically aimed at women's health has recently been undertaken. WISEWOMAN is a Centers for Disease Control and Prevention-funded programme targetted at women aged 40–64 years from low income backgrounds (e.g. those with little or no health insurance), in which they are given access to screening and lifestyle interventions aimed at disease prevention.[527] The project offers lifestyle interventions designed to change risk factors for chronic diseases, especially physical inactivity and diet. Specific interventions included structured counselling, physical activity classes and walking groups. A major emphasis was placed on smoking cessation. Between January

2000 and June 2005 more than 45 000 women were screened for risk factors for heart disease and stroke, and about 119 000 lifestyle intervention sessions were provided. The women who enrolled in the programme during this period were at high risk for heart disease and stroke; 74% were overweight or obese, 27% were smokers, 24% had high blood pressure and 22% had high cholesterol levels. The reduction in CVD risk among WISEWOMAN participants after 1 year ranged from 6% in white women to 8.6% in black women. Evaluation of the programme suggests that *'WISEWOMAN projects faced challenges of integrating clinical and lifestyle interventions, reaching beyond a focus on individuals, marshalling substantial resources, and introducing complex interventions into stretched healthcare environments. The three Phase One projects were deemed successful in reaching underserved women, developing a more comprehensive women's health model, strengthening linkages to primary healthcare, experimenting with innovative behavioural interventions, and tapping into women's roles as social support providers and family/community gatekeepers'*.[528] The overall effects that have been reported to date when comparing the minimal-intervention and enhanced-intervention groups are, however, modest.

Poverty and food and nutrition insecurity

Other evidence reviews that provide useful information include reviews of interventions that have been carried out in low income households with regard to their food purchasing power and associated eating patterns. For example research in Ireland addresses poverty and food insecurity[529] but the researchers do not consider prevalence of obesity. Similarly in Scotland important contributions are made to the debate on poverty and inequalities but associations are not made to the growing prevalence of obesity[530]. A report by the New Policy Institute reviewed indicators of poverty, inequality and social exclusion in Scotland between 1997/98 and 2004 and provided an expert summary of how poverty and social exclusion are interwoven into health outcomes[531].

Overview

In summary, the material obtained from the Medline search showed that there is little hard evidence for positive effective interventions that benefit lower socio-economic groups and reduce inequalities in obesity or obesity-related diet and physical activity. From the literature available, lower SEGs tend to be less responsive to community and school-based health promotion efforts. Behaviour change is only likely if the prevailing social and environmental drivers of obesity are favourable to such change.

4.1.4 Recent community interventions in Europe

A number of school and community-based interventions are currently underway or recently completed in Europe. Those carried out in order to increase children's consumption of fruit and vegetables through school distribution schemes have been reviewed in several papers.[532] [533] [534] Interventions to increase fruit and vegetable consumption among adults, for example through the workplace, have also been reviewed.[535] Although these reviews acknowledge the greater need to increase fruit and vegetable consumption among those from lower income households, and the potential of school, workplace and community schemes to improve consumption among low income groups, no evaluations of the effects on different SEGs are available. The reviews do not attempt to identify the effects in terms of obesity-related indicators, although the review of interventions among adults notes a greater effect of the intervention among those adults with pre-existing ill-health.

Several more recent intervention programmes have been widely publicised in arenas such as the DG Sanco Platform on Diet, Physical Activity and Health. Examples include the *EPODE* interventions (primarily in France but recently expanding into Belgium and Spain) which are based on earlier pilot studies in Fleurbaix Laventie, the *Food Dudes* interventions undertaken in the UK and Ireland, the *Shape Up* schools programme in several countries, the *Copenhagen on the Move* programme in Denmark, the *Albiate in forma* programme in Italy, and the *Fit for life* programme in Finland.

The largest of these, EPODE, will be reviewed by the newly-established EPODE European Network. Although earlier studies in the pilot Fleurbaix Laventie programme appeared to show successful reductions in the prevalence of overweight children through specifically targeted programmes[536] there have been no clear statements regarding differentiated effects across SEGs.

In contrast, the Food Dudes programme has reported on its website that *"the programme is especially effective for those children from lower socio-economic groups"*.[537] The report notes that that the greatest gains, in terms of the quantities of additional fruit and vegetables consumed, were shown by those children who ate least at the outset. Some of the early results have been published in peer reviewed papers.[538] [539]

A review of the Shape Up programme is being undertaken 2007-2008 and other community projects are discussed at the WHO Regional Office collection of projects (see http://www.euro.who.int/obesity/20061117_1). Further detailed examination of these projects is needed to assess their impact on participants from lower SEGs. The proposed establishment of a database of such projects, collated by the WHO, will help in this evaluation.

4.2 Principles of effective obesity prevention

In the remaining parts of this section we look at general principles for intervention, and then in detail at interventions related to the life course approach.

As we have shown above, there is a remarkable lack of evidence on effective interventions for lower SEGs. However this lack of evidence should not be a reason for delaying the development of interventions and policies to reduce inequalities in obesity,[540] but it leaves open the question of what forms of intervention are most appropriate to ensure that the social gradient in obesity is not made steeper by the intervention itself.

The evidence on the links between people's socio-economic circumstances and their health has generated two kinds of intervention approach.[541] The first focuses on those in the poorest circumstances and the poorest health: on the most socially excluded, those with most risk factors and those most difficult to reach. This focus has been important in linking health inequalities to the social exclusion agenda, and in focusing action at local and community level. This approach aims to improve the health of those in the most vulnerable groups, and therefore it will primarily help only a relatively small part of the population such as the high risk groups.

The second approach recognises that, while those in the poorest circumstances are in the poorest health, this is part of a broader social gradient in health, and that a large proportion of the population may be experiencing less-than-optimal health. There are large numbers of people who, while they could not be described as socially excluded, may be relatively disadvantaged in health terms. Preventive and other interventions aimed to improve the

health of much of the population may 'flatten the gradient' although they do not specifically target the most vulnerable.

Both these approaches need to be informed by evidence over time, considering secular trends and the biological and developmental processes (life course), and they also need to be informed by analyses of the social, economic and physical environment.

4.2.1 Health promotion concerns

The systematic reviews and other sources of evidence discussed in this section identified a substantial lack of high quality data able to demonstrate effective intervention that benefited the most disadvantaged groups. With the possible exception of interventions to increase the frequency and duration of breastfeeding, the evidence reviews and guidance documentation provided very few recommendations on good practices, and several reviews identified the paucity of information as a severe gap in the literature.

This conclusion is not unique to the promotion of healthy diets or increased physical activity or the prevention of obesity. In a number of wide ranging reviews of the effects of interventions – e.g. to encourage cigarette smoking cessation, reduced alcohol consumption, or the wearing of seat belts or crash helmets – similar conclusions are reached: namely that there has been little or no evaluation of reductions in inequalities as a result of health promotion programmes. One overview of the literature[542] stated: "*Major health promotion evaluation synthesis endeavours have gathered and synthesized evidence primarily on health promotion effectiveness to improve overall health, seldom on its efficacy or efficiency to do so, and never to our knowledge on its capacity to reduce health inequalities and inequity.*"

Specific problems with interventions have been noted in the systematic reviews above, including the low levels of participation, greater risk of drop-out, and lack of response to the health promotion messages shown by lower SES participants. A good example is the UK *Fighting Fat, Fighting Fit* mass media campaign which achieved a high level of awareness and weight loss of over 4kg for those participants that completed the seven-week programme.[543] [544] However, despite the hope that the programme would influence the more deprived population groups, an unexpectedly high proportion of participants were from upper SEGs. Unintentionally, the social gradient in obesity may have increased as a result of the campaign.

The problem of lack of evidence is in part due to over-strict criteria on what constitutes acceptable evidence for the evaluations of interventions. The need to extend the evidence base beyond the strict clinical formulation of randomised controlled trials (RCTs) to include other forms of evidence has been recognised in public health and health promotion circles for several years.[545] [546] [547] Specifically within the field of obesity prevention, Swinburn and others have proposed a series of different forms of evidence that could be suitable.[548] [549] These authors set the evidence in the context of a framework for making interventions as if they were investments, using a "promise table" which analyses potential interventions on the basis of their levels of likely return (population impact) against their levels of certainty (strength of evidence). This provides a potentially useful tool for future evaluation of impacts of preventive actions on obesity inequalities.

Ideally interventions at population level should be designed to help disadvantaged sections of the population to have better access to health-enhancing environments while providing benefits to the whole population. For example: lowering the price of fruit and vegetables

could be considered a benefit to all while being of particular benefit to those for whom food purchases are particularly price-sensitive; encouraging manufacturers to reformulate their products to improve their nutrient profile; reducing the duration and frequency of advertising for energy-dense, nutrient poor foods; and providing free, fresh drinking water and fruit and vegetables in all schools. Similarly with regard to physical activity, the provision of a network of safe cycle lanes, speed restrictions for motorised traffic and better policing of streets may benefit all, but especially members of lower SEGs.

However, population-wide interventions are not certain to reduce inequalities. Standards for school meals were recently introduced into the UK, but such meals are optional and must be paid for, except for children of low income parents who apply to have free meals. The new standards may benefit those children who take the meals, but will not affect those who do not, including those who do not want the stigma of being seen not to pay for them. A local swimming pool may provide community-wide exercise resources, but if the entrance charge is high – for example higher than renting a video or DVD – then the advantage may only be felt by the better off.

Whether at population level or targeted, proposed interventions need to be examined for their potential impact on members of different socio-economic population groups. As recommended in the EU Health Strategy *'Together for Health: A Strategic Approach for the EU 2008-2013*' health impact assessment should include an inequalities impact assessment as a central theme in the evaluation of all policies and interventions likely to affect health, and this should also include obesity and its determinants.

4.3 Improving health throughout the life course

There are a number of opportunities for health promotion through the life course which can only be touched upon here, but which traditionally offer forms of support and intervention designed to improve health outcome for lower income groups. These include:

- Women's health and maternity services
- Infant and young child services
- Child and adolescent services
- Services for adults and older people
- Community support services for marginalised populations

4.3.1 Women's health and maternity services

Women in lower SEGs are experiencing high levels of obesity in much of the EU and the implications for women of childbearing age are of particular concern, because of the impact on the next generation. Pregnancy is a critical life-course event yet few studies appear to have integrated a life-course approach to health promotion interventions. A life-course approach should address prenatal, postnatal, physiological, environmental and behavioural mechanisms that occur at different stages in the life of the mother and her child. The associated risks include specific causes at critical periods mapped onto already-accumulated risk factors from earlier in their life.

The woman's role as the family's gatekeeper of health[550] and food security provides a focus and a possible opportunity for interventions to reduce levels of obesity within the lower socio-economic groups. A systematic review of qualitative studies describes low-

income mothers' accounts of 'managing' in poverty and includes 11 studies that focus on diet, nutrition and health in poor families and values concerning 'good' mothering[551]. Interventions directed to support women could be implemented via key entry points, such as before, during and after pregnancy. However the actions of women are mainly influenced by her life circumstances: available money and time; skills about how to budget; access to shops and availability of healthy food; social pressures and cultural norms within their families and society. In addition transport and the safety and attractiveness of the immediate area to facilitate physical activity[552] will influence her behaviour.

Drawing on a systematic review of 12 qualitative studies of low-income parents, Attree[553] investigated the experiences of parents of informal networks and official health and social support services. Paradoxically, it is the most socially isolated women who are least willing to seek professional help. Overall, low-income parents' experiences of formal health and social welfare agencies are mixed, and not always positive. The review suggests that naturally occurring support systems provide both material and emotional help to parents, but this support has certain inherent drawbacks such as not being universally available. Low-income lone mothers appear to have smaller support networks and are more reliant on mutual support than two-parent families. In conclusion, Attree suggests that official support services have the potential to fill gaps in informal support systems for poor families, but only if services are provided in ways which are sensitive to their clients' needs. Therefore, information about the parents' perspectives are essential to informing maternal and child services what types of interventions are likely to be most effective.

A range of interventions are required. These should include financial support through employment benefits and welfare food systems as well as support for parenting practices such as breast feeding[554]. For example adequate paid maternity leave (for a minimum of 6 months) will help to support exclusive breast feeding. International maternal protection at the workplace endorsed globally by UN Member States is legal recognition of the contribution that women make to the economy by having children.[555] The elements of maternal protection at work include: scope, leave, benefits, health protection, job protection and non-discrimination, breastfeeding breaks and breastfeeding facilities.

Another wide-ranging initiative is the Baby Friendly Hospital Initiative (BFHI). The aim is that every facility providing maternity services fully practices all ten actions set out in the joint WHO/UNICEF statement on "Protecting, promoting and supporting breastfeeding: special role of maternity services". A recent review on interventions to support breastfeeding mothers confirmed that additional professional support is needed to promote breastfeeding.[556] Correct breastfeeding and infant feeding practices will be most effectively sustained when all the BFHI ten steps are implemented together, including continuing support for mothers in the community to ensure support from the general public and employers.[557] Evidence of a positive shift in public attitudes towards breastfeeding in Scotland paved the way for the introduction of legislation on breastfeeding in public places, making it illegal 'to prevent a child being milk fed in any public place he is entitled to be'. This highlights the value of increasing acceptance of breastfeeding by the general public and the willingness by the government to implement legislation to protect women and infants.[558] The BFHI model provides a good framework on which policy makers can build additional life-course interventions aimed at supporting women in low income groups before, during or after pregnancy.

A study in the Netherlands[559] found that pregnancy is an occasion when women become more aware of nutrition and seek information about healthy eating. Relatively little is known about the motivations women have to improve the nutrition and physical activity patterns within their family. The Dutch study found that women mentioned that a healthy diet was more important for them after delivery than it was before they became pregnant. A healthy diet had turned into a routine habit during pregnancy and the women reported that they felt better due to eating a healthy diet. Interestingly those with lower socio-economic backgrounds tended to rely more on their social environment to obtain information and preferred to learn from their peers. Relatively little is known about the processes that underlie the behavioural changes of women during pregnancy. Most of the nutrition interventions appear to use the knowledge-attitude-behaviour model where exposing the women to new information is assumed to lead to a change. However, as noted earlier, education on its own is unlikely to be successful especially in groups with low socio-economic status.[560]

Adolescent mothers

Adolescent mothers are a highly specialised population in need of focused attention, especially as some studies suggest a relationship between adolescent growth and higher weight gain during pregnancy resulting in excess weight retention after delivery.[561] In the UK the number of teenage pregnancies peaked in 1998 then declined after the implementation of the national teenage pregnancy strategy.[562] The reduction in teenage pregnancies was significantly greater in the more socially deprived areas where, via the intervention, there was the greatest expenditure per head.

The Swansea Sure Start health development scheme started in 1999 in Wales. It provides community development work specifically targeting adolescent parents, to prevent second unplanned pregnancies and includes school programmes. Services are also provided for minority and ethnic communities.[563] Healthy Living Centres (HLCs) [564] in the UK target the most disadvantaged groups and seek to address the wider determinants of health and health inequalities, such as social exclusion, lack of access to services and socio-economic deprivation. Community Food and Health (Scotland)[565] supports initiatives in low-income communities which help people take up a healthy diet and in Wales a Community Food Initiative[566] also provides a one-stop information and networking resource for community staff and volunteers working in food and health. Initiatives such as Sure Start Centres appear to give promising results of reaching less well-off families and giving less-privileged children a better chance. However these types of initiatives have to be funded appropriately to provide the kind of expert services and intensive help needed. Pilots and small schemes show what can be done but these need to be universal and implemented via national policy.

Schutzengel (Guardian Angel) is a project offering health and social support to families in difficulty in the deprived area of Neustadt in Flensburg, a city in the northern part of Germany. The area has a high proportion of young and single parent families living off of state benefits who face difficulties with debt, alcohol or drug addiction and social exclusion. For these persons, there is no tailored help (from existing social institutions) when a new baby is born and young children are at risk of developing disorders as well as facing neglect and abuse. Guardian Angel[567] aims to help families with problems as early as possible - during pregnancy, after the birth and before children reach the age of three. By this point many children have already developed behavioural problems, which prevent them from entering normal kindergartens and nursery schools. The project is based round visits to homes by midwife and family support worker and a Parents' Café for parents-to-

be and those with young children. Most importantly, the project tries to connect with existing helping systems (medical and social care) which is cost-effective and allows sustainability. Guardian Angel is regarded as a model project helping some of the most hard-to-reach families whose children are at risk. Over 2,000 people visited the café in 2003. The Schutzengel project proved to be an effective prevention model for socially disadvantaged families or mothers with children aged 0 – 3 years[b].

Interventions to support optimal weight during and after pregnancy
Given the increase in pregnancy weight gain in Europe[568] preventing excessive gestational weight gain is potentially very important in reducing levels of obesity among women of childbearing age. As discussed in earlier sections, there is a need for new EU guidelines concerning dietary intake and physical levels during pregnancy.[569]

Few intervention studies aimed at weight management during pregnancy have been performed.[570] One study[571] examined the efficacy of providing education and behavioural strategies for low-income pregnant women to promote healthy eating, moderate exercise and appropriate weight gain. The intervention decreased significantly the proportion of women exceeding the IOM's recommendations for weight gain among the normal weight women but not among the overweight women. A similar investigation was carried out in Denmark[572] where obese women were monitored to ensure they gained the minimum weight necessary during pregnancy to ensure a healthy infant. The intervention group (23 women) received 10 dietary consultations of 1 hour each with a dietitian aimed at limiting their weight gain during pregnancy to 6 kg. The control group (27 women) were instructed to eat a healthy diet according to the official Danish dietary recommendations. There was a significant difference between the groups and the intervention group restricted their total weight gain during pregnancy to an average of 6.6± 5.5 kg compared with a gain of 13.3±7.5 kg in the control group. In addition the intervention group retained almost 7 kg less than the control group 4 weeks after childbirth. Moreover there were no adverse effects on the birthweights of the offspring from the intervention group. The conclusion is that pregnancy could indeed be a stage in the life-course when lifestyle interventions are likely to be successful because women are highly motivated to provide the best care for their infant. More research is needed before clear recommendations can be made, but preliminary results appear promising.

The New Life(style) study[573] is an individually-tailored new intervention program, which focuses on controlling weight development during pregnancy. The effectiveness of the New Life(style) intervention program versus usual care by midwives is being evaluated in a randomised controlled trial. Primary outcome measures include body weight and BMI. Secondary outcome measures include physical activity and nutrition. Results of the trial will improve the knowledge of determinants of weight gain during pregnancy, weight retention after childbirth and of the effectiveness of the intervention program. Some weight loss interventions for postpartum women are being carried out[574] where participants are advised both to restrict their energy intake and to increase physical activity. In one study[575] a mean weight loss of 0.5 kg per week over 4-14 weeks was reported.

It is recommended that pregnant women remain physically active during pregnancy, in the absence of contra-indications,[576] because of the beneficial health effects for both mother and child.[577] [578] Similar recommendations have been produced by Royal College of

[b] The evaluation report written in German can be downloaded at: http://www.schutzengel-flensburg.de/Dateien/Modellprojekt-Schutzengel.pdf.

Obstetricians and Gynaecologists in 2006[579] in support of guidelines from the American College of Obstetricians and Gynaecologists.[580] Moreover the primary health care system should be better geared to provide guidance during pregnancy. This could include guidance on both healthy eating and physical activity and to dispel common misconceptions about physical activity and exercise during pregnancy (e.g. "exercising is dangerous", "a lot of rest is good for pregnant women") and safe, enjoyable, accessible and feasible physical activities could be discussed with individuals or groups during antenatal courses. Similarly women should be recommended to maintain physical activity levels during lactation and be reassured that participation in moderate physical activity will not compromise breast milk supply or infant growth.

Concerns about low birthweight

Past efforts to advise women on weight during pregnancy have focused very little on maternal obesity. Indeed most attention has been devoted to concerns about low birthweight and the foetal and developmental origins of chronic disease. Traditionally there has been concern about intervening during pregnancy because of the fear of causing harm to the foetus and focus was on preventing a low birthweight infant. In retrospect, the health care services may need to review their role. It appears that the number of low birthweight births has decreased and in contrast infants are being born with extremely high birthweights (>4kg). In Denmark the mean birthweight has increased 45 grams and the number of babies greater than 4kg has increased to 20%.[581] In Sweden during the same period there was between a 23% increase in the incidence of large infants which is related to an increase in maternal BMI and a decrease in smoking.[582] Authors of a nationwide cohort study, also in Sweden, recommended that women should avoid gaining weight between pregnancies and that overweight and obese women are likely to benefit from weight loss before becoming pregnant.[583]

It appears that obesity has gone relatively unnoticed by maternal health services until recently. In a study in the UK[584] the authors recommend that overweight pregnant women should be supported to lose weight and that there is a lack of weight management guidance. The study recommends routine monitoring of the height and weight of pregnant mothers in all maternity units. This will allow comparisons between different social groups, age-groups and mothers having their first child. It will also enable the effectiveness of health promotion activities aimed at pregnant mothers to be evaluated.

Based on the likely economic and social impacts of maternal obesity, action is needed to address weight gain before, during and after pregnancy as soon as possible. Interventions are needed to show how health professionals can better support overweight women to successfully breastfeed and improve infant feeding practices as well as control maternal weight. Behavioural changes[585] and the sustainability of interventions will only be possible if the societal, cultural and living, conditions are addressed along with individual counselling. As discussed previously socio-economic status and low income including: living in poverty; low educational attainment; young motherhood; ethnicity; unemployment; and family social and cultural norms all play a major role.

In conclusion pregnancy may be an event during a woman's life-course that triggers her to become more nutritionally aware and ready to seek information and this could have long lasting effects for her and her family's health. The lack of evaluation in community interventions in Europe adds to the lack of evidence to inform policy and programme development.

4.3.2 Infant and young child services

There are good economic arguments for providing high levels of investment in the health of children in their early years. For example, the return gained from investing in brain and cognitive development while a child is young is higher than the return gained from the same financial investment made at a later age.[586] Early investment in pre-school is harvested over a longer period of time because early cognitive development and non-cognitive development, such as motivation, perseverance, and tenacity are important and help to facilitate later learning. Healthy physical growth facilitates psychological development. Investing in early years means supporting parents and ensuring all professionals responsible for pre-school children are trained in how children should be brought up in an environment, where there is access to food and nutrition security and daily, safe physical activity.

Infant mortality

Because of the higher infant mortality rates found in lower social groups, reducing infant mortality is often a target that governments set to reduce national health inequalities. For example in Scotland the infant mortality in the most deprived quintile of the population was 784 deaths per 100,000 births compared with only 427 deaths in the least deprived quintile in 2001[587]. Moreover infants born to obese mothers may be more likely to die before their first birthday, as observed in Denmark[588] and the US.[589]

The increase in prevalence of maternal obesity may contribute to the difference observed in infant mortality rates within different social groups. Indeed in England, where the Department of Health has a target to reduce by at least 10% the gap in infant mortality between lower socio-economic groups and the population as a whole,[590] more than a quarter of this target (i.e. 2.8% of the gap) could be achieved if the prevalence of maternal obesity in lower SEGs could be reduced to the national average (Department of Health, England, personal communication).

Interventions to improve infant feeding practices

As discussed earlier there is good evidence that breastfeeding support interventions are effective in helping women in low income groups to breastfeeding and these interventions could be expanded to include other infant feeding practices. To gain an insight into parental perceptions of infant feeding practices in Germany, Italy, Scotland, Spain and Sweden an exploratory investigation[591] was carried out. Various aspects such as social and cultural settings for the consumption of food, infant feeding practice and behaviour, consumer health awareness and sources of information, and attitudes towards a healthy infant diet were included. It appeared that parents did not adhere to infant feeding guidelines and a number of cultural differences in attitudes towards infant feeding practice were revealed. This makes European wide approaches to promoting healthy infant feeding difficult as different infant feeding practices are influenced not only by parental perceptions but also by advice from health professionals.

Appropriate breast-feeding and infant feeding practices is protective for infants and young children and in addition may also have a long-term impact on the health of the population. As discussed elsewhere optimal infant and young child feeding practices have the potential to greatly reduce the obesity gradient, as shown by disparities in breastfeeding rates between countries (e.g. Norway compared with Ireland) and within countries by social class (e.g. Italy and UK). The promotion of optimal infant and young child feeding

practices should form the basis of public health interventions and has the potential to reduce the childhood obesity epidemic and improve growth and cognitive development.

Pre-school children
In the USA, a study of health care professionals provided some insight into the barriers health professionals may face when counselling parents of overweight young children.[592] They reported that, in the families, mothers were focused on surviving their daily life stresses and used food to cope with these stresses and as a tool in parenting. A systematic review of interventions to prevent the development of obesity in pre-school children suggests that the effectiveness of interventions targeted at children aged 2 - 5 years and their families and carers, in terms of helping children maintain a healthy weight or prevent overweight or obesity, is equivocal.[593] The studies suggest that small changes may be possible, and interventions are more likely to be effective if they are specifically focused on preventing obesity (rather than changing diet and physical activity), are intensive, costly, targeted, and tailored to individual needs.

A review of the effectiveness of interventions to promote healthy eating in preschool settings for children aged 1 to 5 years found that, while most studies demonstrated some positive effect on nutrition knowledge, the impact on eating behaviour was less frequently assessed and the outcome was variable.[594] Studies of family-based treatment for overweight have indicated the need to consider the role of parents in the process: one study indicated that treating the mother and child separately appeared to be significantly more effective than treating them together, or treating the child alone, but in another study there was no significant difference in effect on weight outcomes between treating the parent and child together or separately.[595] Interventions that link school and home activities appear to influence knowledge but not necessarily changes in behaviour[596] and tend to be more resource-demanding than child based interventions conducted in schools.

Dental services
Healthy teeth are essential to the ability to eat nutritious foods such as fruits and vegetables. It is during infancy and early childhood that the foundations of good oral health are established. In Scotland a new programme "Starting Well" (the early years demonstration project) targeted on areas of greatest need include encouragement through support from public health nurses early engagement and registration with dental services for those most in need. This programme combines intensive home visiting support for children (0-3 yrs) and families with enhanced access to community resources. This will be evaluated over 3 years and expanded after learning lessons from the evaluation process.[597]

4.3.3 Services for children and adolescents

There is a strong positive association between socio-economic disadvantage and obesity in children and adolescents. Failure to optimize physical and mental development when young can lead to intergenerational cycles of poverty, social exclusion and poor health outcomes.[598] [599]

The school is for most children and adolescents the location where they spend most of their time when they are not at home. It represents an important setting with regard to opportunities for health promotion regardless of gender, age, social group or ethnicity. School is also conducive to reaching the most vulnerable and deprived children, assuming that they are enrolled – some migrant and travellers' children may not attend school sufficiently to be influenced by school health promotion. The challenge is to integrate

health promotion in the educational system of schools, to plan and coordinate different interventions so that they address specific needs and to combine approaches in order to achieve significant effects on health behaviour.[600 601]

As discussed earlier in this section few trials of obesity prevention initiatives (most of which are undertaken in schools) appear able to demonstrate significant effects on indicators of adiposity (e.g. [602 603 604 605]). Reviewers note that effectiveness may be increased by linking the school-based programme to out-of-school action, through the family and community, and focusing on a health promoting environment in the school (including e.g. addressing marketing and private sponsorship). For example recent guidance to Scottish schools requiring them to discuss any sponsorship contracts valued at more than £3000 with local authorities suggests a willingness in Scotland to tackle some of the broader issues related to poor dietary health.[606] Guidance to curb advertising in schools was developed by the Scottish Consumer Council working with the Scottish executive, local councils and the business organisation CBi Scotland. This could be a forerunner to the regulation of commercial food promotion to children at a European level.

Several Europe-wide networks and initiatives aim to create a whole-school approach in educational settings. One of the most long-standing and effective is the European Network of Health Promoting Schools. It is based on the principle that health is not just a matter of what individuals do to look after their own health but is shaped by the context in which they find themselves, where not only the physical environment but the surrounding ethos and relationships can support, or indeed undermine, health. To date this network spans more than 40 European countries.[607 608] An early systematic review of the effectiveness of health promoting schools found that the evidence available to support the health promoting schools approach was promising, where specifically this approach is able to impact positively on aspects of mental and social well-being and on the social and physical environment of the school in terms of staff development, school lunch provision, exercise programmes and social atmosphere.[609] These results were echoed by a more recent WHO review of reviews.[610]

Interventions to improve food and beverage intakes

There is evidence children who skip breakfast may be at increased risk of weight gain and that children from lower SES families are especially at risk.[611] Although the evidence for school breakfast clubs being able to promote health dietary patterns and healthy body weight is equivocal school nutrition policies that include breakfasts, vending machines, snacks and meal services can be effective in improving dietary patterns in disadvantaged school-children and adolescents.[612 613 614] Furthermore, there is evidence that where school meals services are failing to meet good nutritional standards, children from more deprived backgrounds tend to select the least healthy foods.[615]

A school food policy will set a framework for all food-related activities in school, ensuring that aims and outcomes are consistent with and supportive of the overall goal of improving health and well-being and of a whole school approach.[616] The WHO Regional Office for Europe[617] and others, such as Sustain's Grab 5! Programme,[618] have set out guidelines for developing a school food and nutrition policy. Key elements include involving all key actors including parents and the wide community, and focusing on health food at school e.g. through breakfast clubs, which will also allow deprived children to have a healthy breakfast. The UK National Heart Forum has compiled a checklist for setting up a breakfast club reported in their Food and Nutrition Poverty Toolkit.[619] Some of the key steps include: assess parental interest; identify fundraising needs; decide how to

collect breakfast club fees from the children/families; enlist support from staff (head and other teachers, school nurse) and volunteers; and set up management committee.

Taste and availability have been identified as the most important determinants of fruit and vegetable intake in children.[620] Availability is particularly important to address because it influences intake even when preferences are low. Therefore the need for greater availability of healthy food and beverages in schools should be a priority for policy makers.[621] If energy-dense snacks and beverages are bought by children, these unhealthy foods displace fruit and vegetables and contribute to a higher risk of obesity.[622] School food prices significantly affect choices, especially for children from low income families.[623] There is some evidence indicating that reducing the price of fruits, vegetables and other healthy snacks at the point of purchase (vending machines, cafeterias) increases their consumption and those financial incentives may result in temporary weight change.[624] In addition the more vending machines there are in schools the lower the intake of fruit and vegetables.[625]

Free school fruit and vegetable schemes increase availability at school and this is proven to be an effective way of increasing the intake of fruit and vegetables among children[626]. For example in Norway free fruits and vegetables are provided for all children in day-care centres and primary schools.[627] In the project fruit and vegetables in 6th grade, nine primary schools in Hedmark County took part in the "free fruit at school" scheme in the school year 2001–2002. Everyone ate more fruit, regardless of their previous eating habits, gender and social background.[628] One year after the project, pupils were still eating more fruit and vegetables and preliminary findings after three years appear to show the same tendency. This evidence helps to show that free fruit can bring about permanent changes in children's eating habits. Children of parents without higher education who received free fruit also reduced their intake of unhealthy snacks such as fizzy drinks, sweets and crisps after the period of free fruit. Initially, these children ate far more unhealthy snacks than children of parents with higher education. The evaluation in Norway finds[629] that a scheme that reaches all children and young people because it is free can help "flatten" the social gradient in intake of fruit and vegetables.

However if fruit and vegetables are not supplied free of charge, those children living in low income families may not be able to afford them. Thus providing free fruits or making them easily accessible in schools is being considered in several countries including the Netherlands, Norway, France, the United Kingdom and Latvia.

Latvia has recently amended a school food hygiene law and all foods and drinks with additives and too much salt are now banned from kindergartens and schools.[630] [631] It is now prohibited to distribute in the educational establishments drinks with colorants, sweeteners, preservatives, caffeine and amino acids. Specifically, the following foods and drinks will no longer be available in education institutions: Soft drinks with added colours and sweeteners (E-numbers are specified), preservatives, caffeine, and amino acids; Sugar confectionery (candies, caramels) with specified added colours and sweeteners; Chewing gum with specified added colours; and Products which contain 1.25 g or more salt per 100 g and/or 0.5 g or more sodium per 100 g, unless they are used as a raw material for food preparation in catering. These include potato, corn and other chips, salted nuts, salty snacks.

Interventions to improve physical activity patterns

For a significant proportion of children, physical education is the main opportunity to engage in adequate levels of physical activity.[632] In a Cochrane review of physical activity interventions, it was shown that an increase in physical activity at schools can be done by increasing the number of physical education in the curriculum or by extra-curricular, supervised sessions (e.g. lunchtime exercise clubs, after school exercise, etc.). Studies with a moderate increase (e.g. 3 x 30 min weekly) have seldom been able to increase total physical activity or decrease obesity.[633] Well-planned physical education can help in improving skills and physical self-esteem, which then may lead to increased physical activity during leisure-time.

The Health Behaviour School Survey demonstrates that girls show the most marked decrease in physical activity and are significantly less active compared with boys of the same age. One reason may be that school playgrounds and physical education lessons seem to be better suited to and motivating for boys than girls. Increased physical education in schools should therefore ensure these are designed to attract girls to participate, and broader approaches to increasing physical activity should continue to be developed.

One such approach is 'active travel' or 'active transport' to and from schools, a growing movement in Europe. While it appears that the general promotion of active travel may not be effective,[634] targeted programmes with tailored advice do appear to change travel behaviour of motivated subgroups. Active travel can be a good way to include all children in a low cost activity which increases social cohesion by gathering neighbourhoods and provides the opportunity for physical activity.[635] [636]

Health services

Health care professionals, including school health services, school nurses, family health visitors and primary care professionals are in a key position to support weight gain prevention and weight loss management in children and adolescents.[637] [638] Experience with childhood obesity screening has developed in the last two decades and some guidelines are available.[639] [640] [641] It is controversial whether childhood obesity screening programmes should be initiated unless good follow-up resources for treatment are available. Screening large numbers of children is expensive and can divert both staff and financial resources from other health services activities. A recent review finds that the evidence for screening in children is limited.[642]

Though some studies find that adolescents might perceive their health care providers as a valuable source of care and information,[643] [644] adolescents may be harder to reach as they seek independence in decision-making and may fail to attend appointments.[645] School health services can contribute to developing new outreach strategies, for example involving communication through the internet, better involvement of adolescents in their own management programmes and peer support strategies.[646] There is some evidence of at least short-term success in management of adolescent obesity with a phone- and mail-based behavioural intervention initiated in a primary care setting.[647] Free, anonymous clinics for adolescents may also meet the needs of those feeling stigma or discrimination and those unable to afford or access obesity clinics.

As far as possible school and primary health care providers should involve parents and other key actors and focus on healthy lifestyles (as opposed to focusing only on weight loss): Dietary changes alone are unlikely to have much effect without focusing on other long-term lifestyle changes, including increased physical activity, psychological support

and an interdisciplinary management regime.[648] Research on physical activity in obese children has found that having a supportive network from family, peers, physical educators and teachers can lead to lasting positive effects of physical activity therapy until adulthood.[649] Several studies have shown that long-term maintenance of weight-loss (i.e. from 2 to 10 years) can be achieved when the intervention is family-based.[650] [651] [652]

Dental services
Dental health programmes should be linked to health promotion initiatives. School dental inspections are carried out for all children when the start school in Scotland and again at around the age of 11 years. All children are also given a free oral health pack when they start school. The most deprived areas have additional school based preventive dental services and the Scottish Health Promoting Schools Unit also provides professional support and guidance to local authorities.

4.3.4 Services for adults and older people

As discussed earlier adults on low incomes tend to be less likely to consume healthy foods and are less active. Seidell et al[653] argues that it is essential to design interventions that prevent adult obesity because cost-effectiveness of preventing obesity continuously improves with age, right up to older age-groups. The sharpest increase in the incidence of obesity is in adulthood and adults usually continue to gain weight during adulthood. Although for many diseases the relative risks for disease associated with obesity decrease with age, the absolute risk and population-attributable risks increase with age.

Interventions to improve food and beverage intakes
Specific local actions for lowering barriers to health behaviour in community settings have been collated by the UK National Heart Forum[654] and include: providing help with money matters (debt counselling and claim benefits); providing support to improve skills and knowledge; providing better housing conditions and cooking facilities; improve access to affordable fresh food, especially fruits and vegetables; and help to change food preferences by providing opportunities to try different foods without fear of waste.

In Denmark, a work-site canteen model study was very successful in increasing the intake of fruit and vegetables. Also in Denmark, the 6-a Day coalition piloted a worksite free fruit scheme. Results showed a significant increase of 70 g fruit per day for employees at intervention workplaces. As a consequence, the number of Danish workplaces funding free fruit increased from 623 in 2001 to 4986 in 2003.[655] Such initiatives are important in that they help reduce the amount spent on food. In Finland authorities were able to dramatically increase the consumption of fruit and vegetables through the introduction of a regulation that required all meals provided by public food service outlets to include vegetables or salad.[656] Though evidence of effectiveness of workplace initiatives to control overweight and obesity is not strong, employers might nevertheless be encouraged to provide such programmes. The literature supports an emphasis on interventions combining instruction in healthier eating with a structured approach to increasing physical activity in the worksite setting.[657]

Interventions to improve physical activity patterns
A Swiss study focused on encouraging stair use and found statistically significant positive results on physical activity levels.[658] Facilitating active transport and pedestrian access to public transport has important health benefits for people, especially those with low incomes.[659] An example is "Going to work by bike"[660] campaign in Germany where in 2001 a cycling club and a health insurance firm started a joint campaign to promote

healthy everyday cycling, including awards and prizes. By 2004, more than 60,000 cyclists from over 3,200 companies participated.

Changes in the built environment can contribute to enabling people to be more physically active.[661] Reviews on the subject have found a positive association between physical activity and key factors including perceptions of accessibility, actual accessibility, neighbourhood 'walkability' and aesthetics. For example an intervention study on street lighting in London found that lighting improvements greatly improved public confidence, greater use of streets after dark and generally more walking.[662]

Older people

Older people appear to show reduced overweight and obesity prevalence levels due to (a) a selective attrition due to higher mortality rates from disease and/or (b) a healthier lifestyle during their younger years. Therefore the implementation of healthier dietary and physical activity patterns throughout the lifespan is likely to achieve one of the aims of the EU Health Strategy "*Fostering Good Health in an Ageing Europe.*"

Interventions for older people should involve communities in planning and implementation, incorporating tailored approaches, utilizing rigorous process tracking and evaluation and closely cooperating with the social and healthcare system of local communities.[663] Clarke et al[664] emphasise that in attempting to tackle inequalities, planners must assess each area individually. Local, neighbourhood retailing is not limited to nutrition security, but it also contributes to meeting peoples' daily needs, creating community through spontaneous social interaction, increasing physical mobility and reducing social isolation, reducing unnecessary car usage, and maintaining a healthy local economy with local money.[665]

Kelly & Parker[666] studied retail accessibility of older people in Dublin and reported that out-of-town shopping centres and retail parks offer numerous benefits to the consumer such as lower costs and a wider product choice; but that the location of these developments meant the distance and time spent travelling to shops was a serious impediment to access. Disadvantaged households are more reliant on public transport and are thus particularly vulnerable to the effect of out-of-town developments.[667] [668] A number of ideas on improving access to food include[669]: increasing the number of fresh food markets in urban areas; special food access initiatives such as mobile food shops that supply not only fresh fruit and vegetables, but also heavy items such as washing powder; provision of transport service for disabled people, elderly shoppers and others who require better access to larger grocery stores; shopping delivery services; food co-ops and farmers markets to supply fresh, low cost, high quality produce to those who would otherwise not have access;[670] local urban initiatives such as allotments and communal vegetable plots.

Health services

In clinical services, the traditional approach to weight reduction has been the prescription of diets that provide an energy intake below that of energy expenditure. However, there is limited evidence of the effectiveness of such measures.[671] Seidell et al recommend that in older adults health care professionals should focus on changes in waist circumference rather than changes in weight.[672]

A written, goal-oriented exercise prescription, in addition to verbal advice, has been found to be a useful tool for general practitioners in motivating their patients to increase physical activity.[673] [674] For example a controlled trial on the impact of prescriptions found modest

short-term improvements in physical activity.[675] Morgan reviewed exercise referral schemes and reported that they appear to increase physical activity levels in certain populations, namely individuals who are not sedentary but already slightly active, older adults and those who are overweight (but not obese).[676] Gidlow et al[677] sought to determine the suitability of physical activity referral schemes to different socio-demographic groups. They found that uptake was less likely in younger adults and those from more deprived and rural areas, whereas completion was less likely in younger adults and women. They also found that the likelihood of taking up referral was less in participants from more deprived areas, suggesting that rather than treating referral schemes as the primary care physical activity intervention, they should represent a logical progression in physical activity promotion.

Dental services
Dental health services should be linked with health services, as adults (and particularly older adults) may have variable patterns of dental diseases, root decay and gum disease. There are significant inequalities in oral health in older people and they should be able to obtain appropriate oral health care when required. In addition the reduced mobility and dexterity present special problems for older people in relation to chewing fresh fruit and vegetables and need to be addressed through suitable support services.

4.3.5 Services for marginalised populations

It is well-recognised that those who need health, social and other supportive services most often have the greatest difficulty gaining access to them.[678] Marginalised populations are at greater risk for poor health outcomes such as obesity but this may pass unrecognised because they are often underrepresented in research studies. Even when attempting to assess nutritional status in low income groups, surveys can miss the most vulnerable: for example, the UK dietary intake survey among low-income groups was based on household respondents and thus missed homeless people, travellers, and people in long-stay institutions such as psychiatric hospitals, community hostels and prisons.[679] As discussed elsewhere, a new survey is being carried out in Denmark to address this issue.

Socially excluded people may experience many problems with respect to accessing health care, including service factors (such as site provision), poor literacy, language barriers, cultural beliefs and prejudice on the part of the service providers. A number of good practices therefore aim to overcome these difficulties and contribute to social inclusion by establishing health services that supplement mainstream services.[680] Efforts to improve the health of socially marginalised people can only be achieved if health related services are imparted in culturally sensitive ways, using methods that can be understood by the target population. It is especially important to appreciate how different groups perceive both health and ill-health, and to ensure that interventions are culture-specific.

For service providers, the main challenge is to reach marginalised populations, including ethnic minorities, homeless people, and migrants wherever they may be, to empower them to take action and have a voice, and in the process promote social inclusion. Several initiatives throughout Europe aim to address social isolation, poverty and vulnerability, as documented on the Closing the Gap database[681] and the Communities for Health projects in the UK.[682]

4.4 Conclusion

This section has reviewed the evidence available on effective interventions and found a severe lack of good quality prevention initiatives that have shown a positive impact on the health of lower SEGs and especially on preventing obesity. It notes the difficulty in reaching more disadvantaged sections of society, and the likelihood that the provision of information alone is unlikely to ensure behaviour change if the social and environmental drivers towards poor diets, low physical activity and obesity are not changed.

A similar conclusion was reached in the DG Research-funded PorGrow project, in which over 180 key stakeholders in nine EU member states considered options to tackle obesity and agreed on the need for multiple approaches involving educational and informational strategies, food and catering supply strategies, the provision of better environments for physical activity, and a number of fiscal actions.[683] Similar conclusions were reached by stakeholders involved in the DG Sanco-funded project on options to counter child obesity.[684]

Specific opportunities for interventions through the life course may help to protect future generations from risks of obesity and ill health, but better evaluation of their sustainability and their long-term impact on behaviour and on health outcomes is needed. Targeted life course interventions alone, without concurrent population-wide policy interventions, are unlikely to be sufficient to reduce the social gradient in obesity seen within the European Union.

5 Social and health policies to reduce inequalities in obesity

The previous sections have demonstrated the extent of the social gradient in obesity, the likely determinants and mechanisms and the lack of clear evidence for successful interventions to address the problem. This section examines the current policy frameworks and the need to develop policies and interventions to reduce the social gradient in obesity in Member States and at the European level.

Main findings

- Only a minority of Member States show awareness of links between SES and obesity in their health inequalities and social exclusion policy documents.
- Member State activities to reduce the social gradient in obesity could be encouraged through Special Issue Initiatives undertaken within National Action Plans against Poverty and Social Exclusion.
- Action at Community level to prevent obesity includes 'Health In All Policies' and social inequalities initiatives, which benefit from development through the EU Presidency BATON process.
- Cross-sectoral population wide policies are needed in many areas, such as agriculture and food supply; availability and access to food and physical activity; welfare and social benefits; fiscal policies; and information and marketing.
- Policy-makers trying to reduce levels of obesity may benefit from studying the literature on the limitations of health education as a means of inducing behaviour change and the value of interventions which include participatory approaches in order to gain stakeholder support.

5.1 Member States' policy frameworks

In most EU Member States there is a social gradient in obesity prevalence but this is not always highlighted or even recognised in national policy documents.

Two databases were searched and analysed on the extent to which different European countries are addressing obesity differentials across socio-economic groups. The first database was the list of National Action Plans against Poverty and Social Exclusion (NAPs)[685] available from the European Commission's directorate for Employment, Social Affairs and Equal Opportunities; and the second was the European Health Inequalities Portal,[686] a project[687] funded by the European Commission's directorate for Health and Consumer Protection. The documents were examined to assess awareness about the link between obesity and socio-economic status.

All 27 EU Member States had NAPs on the European Commission's directorate for Employment, Social Affairs and Equal Opportunities website whereas, at the time of analysis (March 2007) only 17 countries were represented on the European Health Inequalities Portal (table 5-1). Out of the 17 countries that had policy documents on both websites only five countries cited the word obesity in relation to inequality. Ten out of the 27 countries mention obesity, five in both policies, six only in their NAPs and five only in their Health Inequalities policy. Out of the ten countries with NAPs but no health policies on the European Health Inequalities Portal only four countries cited obesity as a concern, with four more mentioning nutrition and physical activity. While several countries show

awareness of the existence of the link between obesity and inequalities (see tables below) there is a need for a more coordinated response both within and between countries.

Table 5-1: Countries with policy documents on social exclusion (NAPs) and/or Health Inequalities

Policy documents	Country	No.	Obesity cited	No.	Food and nutrition cited	No.	Physical activity cited	No.
Both NAPs and Health Inequalities	Czech-Republic Denmark Estonia Finland France Germany Greece Hungary Ireland Italy Latvia The Netherlands Poland Slovakia Spain Sweden UK*	**17**	Denmark Finland Germany Hungary UK	**5**	Czech-Republic Denmark Estonia Hungary Ireland Germany Latvia The Netherlands UK Slovakia	**10**	Denmark Estonia Hungary Germany The Netherlands UK	**6**
			(S only) Czech- Republic Ireland	**2**	(S only) #Poland	**1**	(S only) #Poland	**1**
			(HI only) Estonia Latvia The Netherlands Slovakia Sweden	**5**	(HI only) France Sweden	**2**	(HI only) Finland Ireland Latvia Slovakia Sweden	**5**
Only NAPs	Austria Belgium Bulgaria Cyprus Lithuania Luxembourg Malta Romania Portugal Slovenia	**10**	Austria Belgium Cyprus Malta	**4**	Bulgaria Cyprus Lithuania Malta Portugal Slovenia	**6**	Bulgaria Malta Portugal	**3**
Total		**27**		**16**		**19**		**15**

#Poland: Health Inequalities policy document in Polish; S only = social policy only; HI only = health inequalities policy only; (*UK includes Scotland, Northern Ireland, Wales and England)

Table 5-2: Examples of contents from National Action Plans against Poverty and Social Exclusion (NAPs)

Country	Citations from NAPs concerning obesity, food and nutrition and physical activity
Austria	Less favourable socio-economic structures in parts of Austria's east have resulted in a west-east divide (identifiable in e.g. higher mortality and increased incidence of obesity in certain areas of the east). There is a particularly high prevalence of diabetes in low-income districts, especially women in rural areas are affected (with this situation being frequently exacerbated by unemployment). These are the points of departure for directing health promotion and preventative measures towards such regions to assist overweight children and their families. The X Team Power Generation project of Vorarlberg has been chosen as a best practice example.
Czech Republic	The target group for long-term care consists of older persons, persons with disabilities and persons with chronic illnesses who are limited in self-care and independence (assistance with housework, preparation of food, shopping, transport and social activities, etc.) The parts of the minimum subsistence level related to nutrition and other basic personal needs were increased by approximately 3.4%.
Finland	The most urgent task with respect to the development of public health is to reverse the growing trend of alcohol consumption and to prevent excessive weight gain. Obesity is most commonplace among the least educated; especially in the case of women, obesity has a clear relationship with the level of education. Health promotion and reduction in the prevalence of national diseases and their risk factors are influenced with different means of social policy.
Hungary	The health status of the Hungarian public is quite poor by international comparison and is well below what would be possible on the given level of socio-economic development. There are numerous historical, social, economic, and cultural factors behind the exceptionally poor health status of the Hungarian public, the easiest of which to take hold of is lifestyle. Dietary habits in Hungary are unhealthy and a significant portion of the adult population is overweight.
Ireland	Among the key mainstream policy initiatives to reduce health inequalities are developments in primary care provision, improved access to cardiovascular health services, the introduction of policies to reduce health inequalities dues to cancer, policies on obesity, food and nutrition and a refocusing of health promotion policies to address health inequalities in a more co-ordinated manner. Improving Health Outcomes for Children launch a National Nutrition Policy to address Children's Food Poverty and Obesity by 2007 and develop a national database to monitor prevalence trends of growth, overweight and obesity.

Although not an EU Member State, it is useful to note that Norway has an important publication "The Challenge of the Gradient dealing with social inequalities in health and their causes"[688] which is included in the European Health Inequalities Portal. In Norway obesity, nutrition and physical activity are recognised as priority areas for action. Indeed in the latest national strategy (2007) to reduce social inequalities in health the Norwegian government[689] recognises that "to prevent illness in the population, it is important to encourage a healthy diet and physical activity for children and young people" and also highlights services such as Maternal and Child Health Centres and the School Health Service. One advantage of the Maternal and Child Health Centre System is that it is the only arena that has contact with just about all pre-school children regardless of their parents' social position. In addition the Norwegian government believes that expanding the school health service ensures that the children who need help most are able to gain access to that help.

Table 5-3: Examples of contents from national documents on health inequalities

Country	Obesity, food and nutrition and physical activity
Estonia	Overweight occurs more in lower income groups, especially among women, in age group 16 to 54 yrs, and in rural populations. The proportion of respondents who report use of butter as a main fat on bread is higher among men from low income groups than among men with high income groups. The frequency of consuming fresh vegetables and fruits less than two times a week is lower among high income group. It may finally be noted that the widening in inequalities in mortality might in part be caused by widening inequalities in health-related behaviours. For example, increasing inequalities in circulatory diseases may in part be due to increasing inequalities in tobacco consumption, dietary habits and some other risk factors for cardiovascular disease. As compared with economically active group, unemployed have generally less health enhancing behaviour, except in physical activity.
Norway	Nutrition surveys in Norway show that people from the lower social strata have a less healthy diet than people from higher social strata. In certain immigrant groups, there is an excess of overweight, diabetes, poor dental health and vitamin D and iron deficiency. It is commonly found that people with long education have a higher intake of fruit and vegetables and a slightly lower proportion of fat in their diet. It has also been shown that children of parents with higher education have a healthier diet, eat more regularly and appear to have a better body image than children of parents with a short education. The connection between social status and dietary factors probably change over time and are dependent on culture. In Norway, a low-fat diet was associated with the socially disadvantaged in the 1930s and with the more advantaged in more recent years. In the past thirty years, the majority of the population have changed to a lower fat diet. Norwegian market surveys indicate that the disadvantaged social groups follow the same trends that are seen in the advantaged groups, but after a certain time-lag. There are marked social differences in levels of physical activity. According to a recent report from Statistics Norway, more than 26% of people with only primary and lower secondary education state that they never exercise, compared with 7% of those with higher academic education. 41% of those with only primary and lower secondary education exercise at least twice a week, compared with 62% of people with higher academic education. The incidence of overweight and obesity is increasing in Norway. One important explanation is that the population's general level of activity has declined. Both average weight and the proportion of women and men in the 40–42 age-group who are overweight increased between the early 1960s and 1999. On average, men's weight has increased by 9.1 kg, while women's weight has increased by 3.7 kg. In Oslo, there are clear differences between the eastern and western parts of the city in terms of both average body weight and the percentage of overweight people.
Wales	Overweight and obesity levels in Wales are increasing with 51% of females and 53% of males classified as overweight or obese in 1996. It is important that everyone has easy access to sources of a wide variety of food that is both nutritious and reasonably-priced so that everyone can afford to 'eat for health'. This is particularly important for vulnerable groups such as children (e.g. through school lessons), expectant mothers (e.g. pre-conception and 'parenting' classes) and older people. Lifestyle is not only a matter of knowledge and choice - evidence suggests that it is strongly influenced by wider factors related to local and personal situations including educational level, personal skills, peer pressure, and social, economic and cultural factors.

At a national level, poverty and social exclusion issues are generally located within the NAPS whereas obesity is acknowledged as a responsibility within national health inequality strategies. However because of the escalating rates of obesity in low income groups it is clear that obesity needs to be prioritised within a framework that addresses poverty, such as that set out in the NAPS. This would help to raise the awareness of the social gradient in obesity and in dietary and physical activity patterns. It would also provide a framework for a more coordinated approach to the development and

implementation of national and local actions by different sectors and not just the health sector. Such a framework could be provided via a NAPS Special Issue Initiative dedicated to addressing food and nutrition insecurity, obesity and health inequalities.

Table 5-4: National food and nutrition policy documents

Country	Title of the document	Date of finalization or adoption
Bulgaria	Food and Nutrition Action Plan 2005-2010	2005
Denmark	Healthy throughout life – targets and strategy for public health policy 2002-2010 National Action Plan against obesity	2002 2003
Estonia	Food and Nutrition Action Plan 2001 National Strategy for Prevention of Cardiovascular Diseases 2005-2020	2001 2005
Finland	Action programme for implementing national nutrition recommendations	2003
France	National Nutrition Health programme	2001
Hungary	'Johan Bela' - National Programme for the Decade of Health National Public Health Programme – Action Plan 2004	2003 2004
Ireland	The National Health Promotion Strategy 2000-2005 Obesity: The policy challenges. The Report of the National Taskforce on Obesity	2000 2005
Latvia	Healthy Nutrition 2003-2013 – Concept of the Cabinet of Ministers	2003
Lithuania	National Food and Nutrition Strategy and Action Plan 2003-2010	2003
Netherlands	Living longer in good health – Netherlands Health-Care Prevention Policy Time for Sport – exercise, participate, perform	2004 2005
Norway	A healthy diet for good health – strategy plan for 2005-2009 Working together for physical activity – The Action Plan for Physical Activity 2005-2009	2005 2006
Portugal	National programme against obesity	2005
Slovenia	National programme of food and nutrition policy	2005
Spain	Strategy for Nutrition, Physical Activity and Prevention of Obesity (NAOS)	2005
Sweden	Background material to the Action Plan for healthy dietary habits and increased physical activity	2005
United Kingdom	Choosing a better diet: a food and health action plan Choosing activity: a physical activity action plan	2004 2005

In addition to general public health and social policy documents, many countries have developed national policies in both nutrition and physical activity which were analysed by WHO with respect to the Ministerial Conference on Obesity in 2006 (table 5-4). However from the WHO analysis[690] only a few countries had a specific action plan or strategy addressing obesity: Denmark, Spain, Ireland and Portugal. In addition, the Netherlands, Norway and the United Kingdom have approached obesity in public health or nutrition plans and separate documents dealing specifically with physical activity.

5.2 European policy framework

In 2000 the European Council set out a ten year plan, known as the Lisbon Startegy or Lisbon Agenda, with the aim of making the EU "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion".[691] The Lisbon Strategy is a commitment by EU governments to concentrate their efforts on a single overarching goal which is to bring about economic, social and environmental renewal in the EU. This stronger economy will help create more jobs alongside social and environmental polices that

ensure sustainable development and social inclusion.[692] Reducing inequalities across the enlarged EU in terms of life expectancy, health status and provision of high quality health promotion services is part of achieving the goal of a more cohesive Europe.

This is highlighted in the EU Health Strategy *'Together for Health: A Strategic Approach for the EU 2008-2013*' adopted by the European Commission in October 2007.[693] The Strategy focuses on four principles including: increasing the focus on Global health including working in closer collaboration with WHO; taking a value-driven approach, which recognises that values relating to improving health must include reducing inequities in health; highlighting the links between health and economic prosperity recommends that EU health-care spending should be accompanied by investment in prevention, protecting and improving the population's overall physical and mental health; and integrating Health In All Policies (HIAP) stresses that population health, e.g. related to food products, is not an issue for the health sector alone. The three strategic themes include *Fostering Good Health in an Ageing Europe*, which recognises that by 2050 the number of people in the EU aged 65+ will grow by 70% and the 80+ age group will grow by 170%. There is clear awareness that healthy ageing must be supported by actions to promote health and prevent disease throughout the lifecourse by tackling key issues including poor nutrition and physical activity.

Health in all Policies (HIAP) is a concept that underpins work on health at the European Level. Under the Treaty establishing the European Community, the EU is required to make sure that a high level of health protection is ensured in 'the definition and implementation of all Community Policies and Activities'. Although a great deal of progress can be made within the health sector, even more can be achieved when sectors work in partnership together to improve the health of the population. The Finnish presidency in 2006 had HIAP as a key health theme and focused on the determinants of health such as nutrition and physical activity, building on the emphasis during previous presidencies on inequalities by the UK and on health determinants by Portugal. Developing work on HIAP involves forging new partnerships across all sectors both at EU and at national level, and putting in place the right systems, such as impact assessment, to ensure the systematic scrutiny of the effects of policies on health. All major new initiatives at Community level must now have an Impact Assessment which considers what impact the policy will have on other sectors, including on health. HIAP provides a challenge to all sectors to ensure they work to improve health by using HIA (health impact assessment).

Examples from different countries suggest that the creation of a dedicated department, such as a Ministry of Public Health can provide a mechanism for improving inter-sectoral collaboration on crosscutting issues, such as food policy, using HIA[694]. For example Slovenia carried out a HIA of their national agriculture policy[695]. This was initiated by the Ministry of Health prior to EU accession because of concerns about possible health contradictions resulting from the Common Agriculture Policy (CAP). One of the most important outcomes of the HIA in Slovenia was that nutritional health goals were considered within the agriculture policy. In contrast a review of the Scottish Diet Action Plan found that the absence of health from the agriculture agenda was one of the key elements missing in the implementation of the Scottish food and nutrition policy[696].

To achieve the aims of the EU Health Strategy *'Together for Health: A Strategic Approach for the EU 2008-2013*' the instruments available to Member States need to be agreed to ensure that they are effective while respecting national policies and differences. Under the Treaty there are a range of possible instruments including binding legislation, 'soft'

legislation such as Council recommendations, and also financial mechanisms, partnerships, networks, and formal structures such as the Open Method of Coordination (OMC). The OMC is currently used in the field of social inclusion and is a process of policy exchange and mutual learning based on agreement of common objectives, development of indicators and establishment of a reporting system.[697] Similar methods of working with stakeholders and international organisations also need to be developed in areas such as food and nutrition and physical activity.

In Europe one of the key barriers towards better health and progress towards a dynamic knowledge based economy is the growing social gradient in obesity. To some extent this has been recognised and strategies, such as The WHO Obesity Charter; The WHO 2nd Action Plan for Food and Nutrition Policy; and EU White Papers, have been developed at the European level. Firstly the EU White Paper "*A strategy for Europe on Nutrition, Overweight and Obesity Related issues*"[698] addresses the morbidity and mortality related to diet and physical inactivity and the related burden of disease. Secondly the EU White Paper on Sport[699] states "*As a tool for health-enhancing physical activity, the sport movement has a greater influence than any other social movement. Sport is attractive to people and has a positive image*." The Commission proposes to develop new physical activity guidelines with Member States before the end of 2008 and will support an EU Health-Enhancing Physical Activity (HEPA) network.

During the German Presidency the Conference "Prevention for Health – Nutrition and Physical Activity – a key to healthy living" was held in 2007. The German conference is part of the larger project entitled "Presidency Baton – disease prevention and health promotion in the area of physical activity and nutrition."[700] The BATON project, which works on the principle of handing on the baton, is to ensure that the discussions and results are taken up and continued by the EU Council Presidencies (e.g. Portugal and Slovenia). A follow-up conference will be organised in the spring of 2008 to evaluate the process.

Improved nutritional status and obesity prevention will remain clear EU priorities. The second Health Programme for 2007-2013, with its budget of €365.6 million, prioritises promoting health by focusing on health determinants such as nutrition and physical activity. In addition under the Fifth and Sixth Framework Programmes for Research (1998-2006), the EU invested €61 million in research in the field of nutrition and obesity projects, with scientists across Member States sharing expertise in order to better understand the issues involved. However given that there is still a lack of information concerning which interventions will be most effective in reducing the social gradient in obesity, nutritional health remains an issue within the 7th Framework.

5.2.1 The European Platform for Action "Diet, Physical Activity and Health"

On 15 March 2005 the European Platform for Action "Diet, Physical Activity and Health" was launched bringing together representatives from consumer organisations, health NGOs and EU-level industry to tackle the EU's obesity problem.[701] The Platform was created *to provide a common forum for all interested actors at European level where (1) they can explain their plans to contribute concretely to the pursuit of healthy nutrition, physical activity and the fight against obesity, and where those plans can be discussed; and where (2) outcomes and experience from actors' performance can be reported and reviewed, so that over time better evidence is assembled of what works, and Best Practice more clearly defined.*

The Platform operates under the leadership of the European Commission whose role is to make sure that a cooperative and action-oriented approach ensures that the activities of the Platform are in harmony with the work of the European Network on Nutrition and Physical Activity, and with the discussions in the Council and the European Parliament.

Nearly 200 new voluntary actions by 34 key European actors from industry and civil society have been triggered,[702] including a voluntary ban by the Union of European Beverages Associations (Unesda) on adverts targeting children and a pledge by members of the European Modern Restaurant Association to provide information to customers on the nutritional content of their meals. Detailed description of each commitment is available at EUROPA.[703]

5.3 Examples of cross-sectoral policies relevant to reducing inequalities

This part of section 5 looks at five cross-cutting, population-wide policy areas which may have a role to play in reducing the social gradient in obesity. The policy areas are:

- Availability and access to food and physical activity
- Welfare and social benefits
- Fiscal policies
- Information and Marketing
- Policies relavent to the lifecourse approach

Unfortunately these policy areas do not lend themselves to evaluation using randomized controlled trials. Demonstrations of the effectiveness of different strategies will need to be evaluated using other forms of evidence.

5.3.1 Availability and access to food and physical activity

Between 50 to 80 percent of all food purchased is bought in supermarkets in Europe and this proportion is likely to increase.[704] With respect to urban planning and availability of healthy food, several European cities are reviewing their citizens´ access to healthier products, especially fresh, perishable foods, within deprived urban areas.[705] Some planning authorities also recognise the problems faced by people living in rural areas, especially for those with poor transport facilities.[706] Resources are needed to undertake mapping exercises to identify areas of greatest food and nutrition insecurity in terms of the location of retail food supplies selling healthier products (e.g. Scottish Office, 2005[707]). Urban food schemes, community cafes and restaurants, food delivery and bussing schemes and other local initiatives exist, but most suffer from short-term funding constraints. To remedy these problems national well-funded initiatives are required to map how far away low income citizens are from retail outlets, selling an affordable range of healthy fresh food, and establish sustainable solutions.

Meals outside the home

The share of expenditure on food eaten away from home as a proportion of total food expenditure varies between 30 to 60 percent in the European region.[708] The available data suggest that frequent fast-food restaurant use is associated with higher energy and fat intake and excess weight gain. One study found a higher number of McDonald's

restaurants per 1000 inhabitants in some deprived neighbourhoods compared with wealthier ones.[709] However, a scientific review of food environments and obesity concluded that the evidence for an effect of the food environment is still not clear[710] and further studies from more European countries are needed.

Retail promotion strategies
How and where goods are displayed within supermarkets has an impact on purchase.[711] The aim is normally to promote sales, especially impulse purchases, such as putting sweets beside the supermarket check-out. A supermarket chain in Denmark developed a social corporate responsibility policy where they promise customers to place fruits at the cash check-outs instead of confectionary. In the UK, the National Consumer Council has run a series of surveys comparing supermarkets for their promotion of healthy and unhealthy foods, using criteria including checkout displays, displays of fruit and vegetables and soft drinks, pricing and special offers.[712] After a supermarket was built in a municipality where fruit and vegetables had not been readily available the purchase of portions increased by 0.25 to 0.5 per day and also walking, to get to the supermarket, increased.[713] However, the arrival of a supermarket in an area can also lead to the closure of smaller, more local shops (including greengrocers and fishmongers) leading to reduced purchases of some healthier foods.

In summary food availability and access in local shops and communities is likely to be a strong determinant of food and nutrition security, dietary habits and linked to the social gradient in obesity. However more investigations are needed into the health impact of different food environments and how they can help to reduce the social gradient.

Public Procurement
One way to support food and nutrion security is to ensure a viable market for local producers. National purchasing authorities can define the terms to create a market through procurement systems in the public sector. Evidence suggests that the specifications developed for procurement of food for schools meals[714] can encourage the supply of fresh healthy food. Model nutritional guidelines for catering specifications and food products for the public sector exist in some countries e.g. Sweden and these should be widely disseminated and implemented across EU countries in institutions, such as hospitals, schools and all day institutions, where public service catering exists. Public procurement systems[715] can also be used to build consumer awareness as well as creating market demand for fresh nutritious food and so help to reduce the social obesity gradient in institutions that are caring for individuals from lower SEGs.

Physical activity
In a review WHO found that in Europe there is no common regulatory approach aiming to ensure provision of areas that allow easy access for physical activity, such as having a minimal amount of green spaces according to the size of the city. It also appears few countries regulate what the distance between home and a park or leisure area should be.[716] Besides physical accessibility, social and cultural norms influence the likelihood of being physical active. Data from Belgium, Finland, Germany, the Netherlands, Spain and Switzerland show that the social cohesion through friends and family support has an influence on the level of physical activity.[717] Social and cultural values may themselves be influenced by the opportunities available in the surrounding environment.

Sustainable transport interventions, such as walking and cycling instead of using motorized transport, needs to be promoted to a greater degree. Policies that encourage

cycling were reported to be successful in increasing levels of physical activity and a significant association was found between the existence of cycling policies and the level of cycling.[718] The urban built environment is increasingly furnished with elevators, escalators and automatic doors, decreasing spontaneous and involuntary physical activity such as climbing stairs. These mechanized options are essential to ensure access for disabled people, elderly people, parents and infants. Nevertheless urbanisation has to take into consideration the impact that mechanization has on physical health and make more effort to make escalators an option to stairs, but not replace stairs entirely. Furthermore social marketing efforts e.g. putting signs next to stairs in public places, reminding people to use them instead of the escalator have proven effective in increasing physical activity.[719] [720]

Socially marginalised neighbourhoods have worse crime and general lack of safety than wealthier neighbourhoods, partly due to poor lighting and poor infrastructure. This greatly reduces the chances of creating socially cohesive communities where vulnerable members of the community feel safe and are not in fear of sustaining a bad fall because of poor pavements, lack of benches, and pedestrian crossings. Urban design efforts should as much as possible take these factors into consideration so that the regeneration of towns helps to reduce the social gradient in obesity by encouraging more physical activity.

Most of these physical activity policies are not developed under the leadership of the health sector but by the transport sector, illustrating the importance of cross-sectoral collaboration.[721]

5.3.2 Welfare and Social Benefits

As discussed elsewhere, obese individuals living in low income areas may become obese because of a scarcity of healthier fresh foods amidst a plentiful supply of energy-dense foods. Those who are obese and living on low incomes may be deficient in essential nutrients and considered the "malnourished obese". This was among the findings of the investigation into overweight children in receipt of benefits under the Women, Infants and Children scheme in the USA. Compared with other welfare recipients in the scheme, overweight children were more likely to suffer nutritional problems: almost 80% of overweight WIC children had two or more micronutrient deficiencies, compared with less than 50% of other WIC children[722].

In Europe in order to compensate for possible shortcomings in the diets of low income families, several countries offer access to low cost or free food items, for those eligible to receive state supported welfare[723]. Free milk to new mothers, vitamin drops, orange juice, free milk and fruit schemes in schools, school meals, subsidised dairy and meat schemes for caterers in social residential facilities, along with food vouchers and food stamps are available in some countries under certain criteria of eligibility. However interventions operated as part of welfare and related policies should be examined to assess their impact and ensure they are in accordance with nutritional goals.

For example concerns have been expressed that the welfare schemes operating in many European countries may be inadequate to cover a 'healthy food basket.'[724] [725] Welfare and other anti-poverty policies may indirectly exacerbate nutrition insecurity. Research has shown that up to 80 percent of welfare payments is required to purchase a healthy diet in Ireland.[726]

An example of a specific initiative addressing socio-economic inequalities and food is the National Healthy Start initiative to reduce inequalities in food poverty in UK. This provides tokens for fruit and vegetables, cereal-based foods, other foods suitable for weaning, liquid milk and infant formula. Registration for the scheme is through health professionals, primarily midwives and health visitors who can support the scheme through the provision of health and nutrition advice to beneficiaries. In addition milk and fruit are provided on a universal basis to children in day care. Similarly Health Action Zones in the UK are examples of multi-agency initiatives based in areas of deprivation and aim to address the public health needs of the local area and pioneer novel methods for tackling health inequalities.

Throughout the UK, many community-based activities have specifically included food projects as a means of achieving health objectives. A literature review of research findings[727] confirms that the family food "gatekeepers", primarily women, attempt to balance their feelings of needing to care for their family with concepts of health and their available skills. Convenience foods are a way of achieving a family meal even if mothers do not regard them as 'proper' food. People's ideas about healthy choices may be more complex than currently understood and that the less-privileged may distance themselves from 'healthy eating' messages. Not only are educational campaigns targeting low income families sometimes inappropriate for those families, but the recommended practices must be economically feasible for them. There appears to be very little evidence available as to why people behave as they do and such evidence is essential if interventions are to be effective in the future. A Europe-wide programme to consider what minimum income level is necessary in each country to ensure families can afford a culturally acceptable, nutritionally adequate diet is needed.

5.3.3 Fiscal policies

As discussed elsewhere, the cost of food in relation to income is a key determinant of eating patterns. It is also well know that low income consumers are more sensitive to changes in the price food[728] and so are likely to be more sensitive to the effects of taxes and subsidies on food prices.

Taxes on food and beverages are common instruments used by governments throughout Europe to raise funds for national welfare benefits. Similar to tobacco and alcohol, taxes are levied on chocolate and sweets, ice-cream and soft drinks. However key stakeholders are likely to raise a number of concerns about the option to levy taxes on food products. Stakeholders in the DG Research-funded PorGrow project[729] felt that economic instruments could have a negative impact on lower income families for whom food costs already took a larger part of their income compared with the better-off. Some stakeholders also believe that it is too complicated to implement different levels of VAT on different goods. Moreover they believe it is not possible to define which foods are "healthy" or "unhealthy" so that the "unhealthy" can be subjected to taxation and the "healthy" subsidised.

Firstly in response to the latter point, it should be noted that the issue of defining what is "healthy" and what is "unhealthy" has already been addressed by governments in Europe. Indeed most countries have dietary guidelines and via health education campaigns it is recommended which foods should be consumed more and which should be consumed less in order to consume a healthy diet. Therefore EU governments have already defined what types of foods could be taxed and which could be subsidised. Moreover criteria for

taxation is similar to the criteria needed for controlling commercial advertising, where definitions already exist. For example in the UK the introduction of controls on advertising to children is based on a nutrient profiling methodology which has undergone detailed scientific evaluation.[730]

Secondly, in response to the argument that it is too complicated to implement different levels of VAT, different levels are levied on different goods in most countries already (Table 5-5). Indeed given the huge variations observed in Table 5-5 there may be a need to agree consistent VAT levels across the EU. For example a problem was encountered when taxes were imposed on soft drinks in Denmark and consumers then made special efforts to collect lower-priced drinks from across the border in Germany. This indicates the need for both cross-national and national agreements on taxation and pricing policies that take account of low income groups, nutrition insecurity and obesity.

Table 5-5. VAT on standard goods and food in different EU countries

	Standard goods VAT (%)	Food VAT (%)
Austria	20.0	10.0
Denmark	25.0	25.0
France	19.6	5.5 and 19.6
Germany	16.0	7.0 and 16.0
Greece	18.0	8.0
The Netherlands	19.0	6.0
Italy	20.0	4.0 and 10.0
Spain	16.0	4.0 and 7.0
Sweden	25.0	12.0 and 25.0
UK	17.5	0 and 17.5

Thirdly a study in price elasticity modelling undertaken in Denmark showed that changes in the relative prices of foods could have significant effects on total dietary patterns, especially for low income families[731] [732] - i.e. that taxation could effectively change the balance of the diet favourably for those most in need. The price elasticity modelling undertaken in Denmark identified a scenario which appeared to have the most impact on low income consumers: in this scenario the VAT of 25 % is removed from the healthy food such as fruit and vegetables while the VAT on foods high in fats and sugars is increased by nearly a third. According to the model there was a clear tendency for the lower income groups to purchase more healthy foods such as fruit and vegetables compared with the higher income groups. Similarly the increased VAT on the unhealthy food would result in both the high and low income groups purchasing less. The analysis of the modelling exercise indicates that economic instruments could play a role in reducing inequalities in dietary eating patterns in different socio-economic groups. The Danish researchers recommended further analysis of the potential of using economic instruments in food and nutrition policy.

Although the Danish research was only a modelling exercise, a supermarket chain (COOP) subsequently carried out a nationally representative survey of consumer reaction to a potential change in VAT policy in Denmark. Interestingly almost three-quarters (74%) of the population supported the policy to increase VAT by 30% on foods high in fat and sugar and remove VAT from fruit and vegetables. Similar results were found in a larger study where more than 85% of consumers responded positively. Therefore adjusting

VAT prices on foods may be a way of making healthy foods more accessible to lower income groups and could be acceptable to consumers in EU countries.

In their strategy to reduce the social obesity gradient, the Norwegian government[733] has taxed non-alcoholic beverages with added sugar and sweeteners, while bottled water and juice are exempt from these taxes. The government would prefer this tax to apply only if the sugar content passes a defined lower limit, motivating the industry to lower the sugar content in beverages. However, a defined lower limit would depend on labelling requirements specifying the sugar content and current EU regulations do not call for this. Norway has thus proposed the need for specific labelling to international organisations.

In addition, calculations carried out by the Norwegian Agricultural Economics Research Institute[734] demonstrate that a 12% drop in the price of fruit and vegetables would cause an increase in the total demand of between 4 and 15%. Among young people living alone and couples with children, total demand for fruit and vegetables would be expected to rise by 11–12 %. These groups currently spend less of their food budget on fruit and vegetables than other households.

Other organisations have been recommending more research on health-related food taxes: the European Heart Network (2002) 'recommends comprehensive and integrated European food and nutrition policy at European and national level…which will include pricing strategies'; the UK parliamentary health committee (2004) stated 'the Government should keep an open mind on this issue … of taxing unhealthy foods'; and the World Health Organisation´s Obesity Charter (2006) states 'other important [policy] tools include fiscal and public investment policies.'

A WHO review[735] found indirect evidence between policy-related economic instruments and food consumption suggesting that such a causal relationship is plausible. Evidence from modelling analyses drawing upon actual market data to track how food purchasing responds to changes in prices suggest that a combination of increased prices (in the form of taxes) on fats and sugar and subsidies or removal of taxes on fruits and vegetables could alter consumption patterns as well as reduce total energy intake. However, these findings from modelling studies do not comprise empirical evidence and these models need to be tested in practice.

In summary, people on low-income are more price-sensitive compared with those on higher incomes and therefore may react more strongly to price manipulations to improve food and nutrition security. Taxes on certain foods and beverages are already used in a range of countries to raise revenue but interventions trials are needed to ascertain if taxes and subsidies could have a benefit on reducing the social gradient in obesity.

5.3.4 Information and Promotional Marketing

Information

As discussed elsewhere information campaigns can increase knowledge but do not necessarily induce changes in food purchasing and consumption patterns of the less affluent. Information campaigns on their own are not likely to be effective in achieving changes in behaviour among lower socio-economic groups and may thus increase the social gradient in obesity.

Nutrition labelling

Nutrition labelling fulfils a consumer's right to information about what nutrients a food contains, but this must be seen in the context of the consumer's level of knowledge and ability to understand the information. Labelling schemes that help consumers to make rapid evaluation of the nutritional quality of processed foods are being suggested as interventions to help combat obesity. The European Heart Network published a systematic review on consumer understanding of nutrition labelling[736] and only four (out of 129) studies focused on low income populations.[737] [738] It was found that women on lower income and with less education are least likely to look at labels. Reasons for not reading labels included lack of time, size of print on packages, and lack of understanding of the terms used.

A survey in four EU countries showed that on average 56% of products included nutrition labelling.[739] In the UK, 75% of all products surveyed were labelled with nutrition information, in Spain 54%, in Germany 50% and in Poland 41%. The food categories labelled most were breakfast cereals, margarine, soups and frozen vegetables, and the list showed either four nutrients – energy, fat, carbohydrates and protein - or eight nutrients - with the addition of saturated fat, sugars, sodium and fibre.

Research into consumers' understanding of nutrition labelling[740] was carried out in Europe among adults responsible for doing the household shopping. Three-quarters of the sample were women. The main sources of nutrition information were TV and the press. The researchers (the consumer organisation Bureau Européen des Unions des Consommateurs, BEUC) recommended mandatory labelling on all pre-packaged foods using a simplified labelling scheme.[741]

Following a consultation on labelling in spring 2006,[742] the Commission is reviewing the options for nutrition labelling legislation with a view to proposing to the EU Parliament and Council that this is strengthened as a channel for information to consumers. Issues being considered include: whether mandatory labelling should be introduced; the number of nutrients that should be included on the label; and the regulation of front of pack labelling (i.e. simplified labelling or signposting). Expression of nutritional content in units and/or percentage of a guideline value is to be determined and whether there should be a link with recommendations regarding healthy diets, and the most appropriate reference quantity for a nutritional declaration, e.g. per 100g or per serving.

The food industry has widely promoted a voluntary front-of-pack scheme offering percentage figures for several key nutrients as a proportion of adult (or child where relevant) Guideline Daily Amount (GDA). Although providing useful details, these schemes have been criticised because of the difficulty faced by consumers when interpreting the numerical information: in the UK some 47% of adults have difficulty understanding the information.[743] [744] [745] Consumers with poor numeracy skills may prefer to be offered logos, such as the keyhole symbol in Sweden indicating relative healthiness of a product, or traffic light colour coding symbols such as those used in the UK to indicate the absolute level of significant nutrients. Criteria for traffic light colour coding (red= "unhealthy" and green= "healthy") are currently being compared with GDA and other front-of-pack labelling schemes with a view to their widespread introduction in the UK in 2008.[746]

One of the key advantages of labelling in general and specifically the traffic light system, is that it encourages the food industry to lower the amount of fat, salt and sugar in their products in order to achieve a better traffic light profile. In the USA, label declarations

have stimulated the food industry to reduce the amount of salt, sugar and fat in a wide range of products.[747] In the UK, the supermarket chain Sainsbury has reported decreased sales of ready meals with several "red" signals in favour of increased sales of similar items with "green" labels, and has subsequently reformulated some of its products to earn a better set of "green" signals.[748]

Health claims

The EU Commission White paper *A strategy for Europe on Nutrition, Overweight and Obesity Related Issues* states that a key objective of the health claims regulation (Regulation (EC) No 1924/2006) is to ensure that nutrition and health claims on foods are based on reliable scientific evidence, so that consumers are not misled by inaccurate or confusing claims.[749]

There is a lack of evidence concerning the effects of health claims on public health. The use of health claims might be assumed to be restricted to health-conscious, affluent groups able to afford the claim-bearing products, which are often more expensive. However people in lower income groups may respond most to marketing and health claims, and aspire to the apparent benefits of a specific health product.[750] [751]

Promotional marketing

Promotional marketing, particularly targeted at young people, is the subject of considerable policy debate. Evidence suggests that promotional marketing does have a significant effect on eating patterns. A review was carried out by WHO and the evidence regarding the influence of marketing of foods and non-alcoholic beverages on children was documented.[752] Systematic reviews examined 65 articles reporting on 50 original empirical studies and 55 articles reporting on 51 original empirical studies conducted worldwide over three decades on the effects of food marketing to children.[753]

None of the research is focused on children in lower socio-economic groups but some of the general findings could indicate that those who are most vulnerable to exploitation are those with lower economic status. For example it appears that after exposure to TV adverts social mediation by parents, peers or others is crucial in order to help children be critical and discern between information and commercial advertising. In addition the socio-economic status of the household appears to be an important factor that affects children's diet as well as parents' own dietary pattern, parents' nutritional knowledge, and norms including the amount of television viewed.[754]

The protection of nutrition security, by protecting healthy fresh wholesome foods (e.g. fruit and vegetables), against competition from less healthy commercially promoted foods is probably necessary. Healthy fresh food is less likely to be undermined if market regulations are implemented to control marketing to children. A precedent exists where the International Code of Marketing of Breast Milk Substitutes[755] and subsequent relevant World Health Assembly resolutions was adopted to protect women from exploitation and aggressive marketing techniques used by some commercial operators. These international resolutions have been implemented into national and EU legislation. Similarly, international organizations could develop an International Code on Marketing of Foods and Beverages to children. Regulations should include controls on the marketing in printed media, electronic media, cross-branding, product positioning (e.g. by checkouts) and product formulation (e.g. use of non-nutritional food additives designed to attract

children to energy dense, micronutrient poor foods). Investigations in Australia into the cost effectiveness of different types of interventions to prevent childhood obesity indicate the cost benefits of controlling marketing to children compared with other interventions.[756]

In UK a voluntary code of conduct was announced by the Committee of Advertising Practice in 2007.[757] The rules ban all print media adverts for food and soft drinks from encouraging under-16 year olds to be unhealthy and apply to newspapers and magazines adverts, posters, cinema and online adverts. Advertisers are also banned from using hard sell promotional offers in an irresponsible way for products aimed at children. Tougher rules apply to adverts targeted directly at preschool or primary age children and all promotional offers and nutritional claims will also be banned in food and drink adverts aimed at very young children. The rules say that children must not be encouraged to snack throughout the day. These rules follow new restrictions on broadcast adverts for food and drinks products which were drawn up by the Communications Regulator in the UK.[758] This states that commercial adverts for products high in fat, salt or sugar cannot be shown in and around children's TV shows and general entertainment programmes which would appeal to a "higher than average" number of under 16 year olds.

Examples of regulations in different countries were reported in the WHO publication on marketing to children.[759] In Quebec the law states that "account must be taken of the context of its presentation and in particular of: (a) the nature and intended purpose of the good advertised; (b) the manner of presenting such advertisements; and (c) the time and place it is shown". A scale chart is used to assess whether an advertisement is directed to children or not (Table 5-6).

Table 5-6. Elements to define an advertisement in Quebec directed at children

Products (Place/time)	**No Appeal to Children** **Products intended for adults & teenagers**	**Marked appeal to Children** **Products intended for families/all age groups**	**Exclusively intended for Children** **Products intended for children with marked appeal to them**
Programmes for children (children make up >15% of audience	Authorised But not with a presentation that is attractive to children	Unauthorised Except if presentation is not designed to be appealing to children so as to arouse their interest	Unauthorised
Programmes where children make up <15% of audience	Authorised But not with a presentation that is attractive to children	Authorised The advert must not be designed to appeal to children so as to arouse their interest	Authorised The advert must not be designed to appeal to children so as to arouse their interest

Source: WHO Geneva 2006[760]

The experts participating in a WHO consultation recommended that WHO should take the lead in development of an international Code on commercial promotion of food and beverages to children and address issues such as cross-border television advertising and all global promotional activities. The European Charter on Counteracting Obesity which stated "*Specific regulatory measures should include: the adoption of regulations to*

substantially reduce the extent and impact of commercial promotion of energy-dense foods and beverages, particularly to children, with the development of international approaches, such as a code on marketing to children in this area".[761]

The issue was also addressed in the World Health Assembly in 2007, in which a resolution on non-communicable diseases mandated WHO to undertake *'…the development of a set of recommendations on marketing of foods and non-alcoholic beverages to children, in order to reduce the impact of foods high in saturated fats, trans-fatty acids, free sugars, or salt…'*[762]

In the EU Commission White paper "A strategy for Europe on Nutrition, Overweight and Obesity Related issues"[763] it is stated *"….advertising and marketing are recognised as powerful sectors that aim to influence consumer behaviour. Between October 2005 and March 2006 the Commission conducted an Advertising Round Table to explore self regulatory approaches and the way that law and self regulation can interact and complement each other. As a result, a best practice model (or standards of governance) for self-regulation was set out in the Round Table report*[c]*. These standards should apply to the specific area of the advertising of food to children. In doing so, voluntary efforts should complement the existing and different approaches being taken in Member States, such as Spain's PAOS code and the recent Office of Communication initiative in the UK. In such a context the request of the European Parliament, regarding the introduction of a code of conduct for advertising of food high in fat or sugars aimed at children during the debate on a modification of the "Audiovisual Media Services" (AVMS)*[d] *Directive, should be noted. The new AVMS Directive foresees that media service providers should be encouraged by the Member States, and by the Commission, to develop codes of conduct regarding commercial communication on food and beverages targeted at children. The Commission's preference, at this stage, is to keep the existing voluntary approach at EU level due to the fact that it can potentially act quickly and effectively to tackle rising overweight and obesity rates. The Commission will evaluate this approach in 2010 and determine whether other approaches are also required".*

5.3.5 Policies relevant to the life course approach

The Global Strategy for Infant and Young Child Feeding[764] was endorsed by all Member States at the World Health Assembly in 2002. It aims to revitalize efforts to promote, protect and support appropriate infant and young child feeding. It builds upon past initiatives, in particular the Innocenti Declaration and the Baby-friendly Hospital initiative (BFHI) and addresses the needs of all children including those living in difficult circumstances, such as infants of mothers living with HIV, low-birth-weight infants and infants in emergency situations.

Governments should review progress in national implementation of the International Code of Marketing of Breast milk Substitutes, and consider new legislation or additional measures as needed to protect families from adverse commercial influences. Governments should enact imaginative legislation protecting the breast-feeding rights of working women and establishing means for its enforcement in accordance with international labour standards. The strategy specifies not only responsibilities of governments, but also of international organisations, non-governmental organisations and other concerned parties. It engages all relevant stakeholders and provides a framework for accelerated action,

[c] http://ec.europa.eu/consumers/overview/report_advertising_en.htm

[d] Previously referred to as the "Television Without Frontiers" Directive

linking relevant intervention areas and using resources available in a variety of sectors. A Blueprint policy document[765] and guidelines[766] on "Infant and Young Child Feeding: Standard Recommendations for the European Union" was funded by DG SANCO and these recommendations assist in implementing the Global Strategy in Europe.

At the European level it is recommended that EU legislation is brought in line with the International Code of Marketing of Breast milk Substitutes and new EU Directives on commercial promotion of foods for children, including a ban on health claims. The industry has an important role in complying with the International Code and subsequent relevant World Health Assembly resolutions which are endorsed by EU Member States. The legislation in the European region is now weaker than in other parts of the world, leaving EU families with less protection. In the countries where controls are enforced, breastfeeding rates are increasing and results in reduced infant morbidity and mortality and helps to prevent development of childhood obesity.

Guidance is also required on how prevent obesity in young children and in Scotland, the government has developed *Nutritional Guidance for the Early Years* and this guidance sits alongside *National Care Standards for Early Education and Childcare.* The relevant services will be inspected against defined standards, including healthy eating for young children. Adventures in Foodland resources are supported by training for professionals who care for young children and considerable local expertise is employed in the early-years sector to encourage healthy eating through a wide range of initiatives. It is important the governmental health, social and educational sectors work together to develop policies that are in accordance with national heath goals to reduce the social gradient in childhood obesity.

5.4 Health education alone is not enough

As mentioned earlier, although health education is an important component of public health promotion, the provision of information to individuals is not enough to bring about changes in behaviour conducive to obesity prevention.[767] This is particularly relevant when considering population-focused strategies to benefit low-income and other disadvantaged groups who may be least able to use information in practice. Traditional approaches to nutrition education have shown limited success in changing patterns of food consumption in low-income households.[768] [769]

Health education traditionally focuses on improving the knowledge of an individual, but this process may fail to acknowledge the wider cultural, economic and environmental influences that shape dietary choices.[770] Even large-scale and long-term comprehensive community health education initiatives such as the Stanford Five-City Project have been shown to lack effectiveness.[771] The authors concluded that they greatly overestimated the ability of the education efforts to accelerate lifestyle and risk factor changes. The fact that sustained multisectoral efforts are necessary is underscored by the success of the North Karelia Project. Here cardiovascular disease morbidity and mortality were dramatically reduced by taking into consideration environmental, industry and dietary concerns.[772]

The conventional model of nutrition education supposes that nutritionists generate knowledge and health educators transfer that knowledge to consumers, where consumers are considered as passive receivers rather than as experimenters and decision-makers. Reviews of nutrition education interventions find that while a focus on individual behavioural change may be effective in the short term, the factors influencing long term changes are environmental, for example broad-based involvement of the school and the

community.[773] [774] Similar conclusions emerge from reviews on the effectiveness of physical activity promotion strategies: physical activity promotion must go beyond the "classic" health education approaches and aim for multi-sectoral and comprehensive changes to the built environment, with the view of making daily physical activity an easy choice.[775] People are best able to lead a health-enhancing physically active lifestyle when reached in their own communities, through their workplaces, schools, the transport system, community recreation centres and nearby parks, trails and sports- and playgrounds. Local involvement is a prerequisite for securing policies, interventions and actions that are sustainable and tailored to meet local needs and adapted to local resources and opportunities.

Thus it is increasingly acknowledged that effective behavioural change will only come about by creating an enabling environment within which health education can best be utilised. The alternative to conventional health education is to build on consumers' capacities to use information when they need it and to enhance their ability to take sound decisions regarding health behaviour. This sort of empowerment aims not only to foster healthy lifestyles but also to enable people to mobilize social forces and create conditions that are conducive to healthy living.[776]

Education and knowledge dissemination should be framed within broad upstream approaches and be effective so as to reach all stakeholders. This can be considered in the light of reducing socio-economic inequalities and calls for a genuine engagement with and delivered across government sectors, society and industry.[777] It is increasingly recognized that education alone is not sufficient to reduce the social gradient in obesity; environmental and societal interventions are key to bringing about and sustaining behaviour change. Effective bottom-up approaches require adequate financing and as much intersectoral collaboration and community participation as possible in order for programmes to be sustainable. Also interventions should be properly monitored, evaluated and documented. This is important for dissemination and transfer of experiences.

There should be comprehensive approaches rather than partial approaches, including approaches that require governments to use their regulatory powers. In the UK[778] and Denmark[779] two debate reports discuss the role of government in public health, such as implementing a ban on smoking in public places, food labelling and food advertising to children. Some argue that government intervention is an unnecessary intrusion into people's lives and what they do, eat and drink. However there is a strong argument for government intervention to safeguard public health. Legislation brings about changes that individuals on their own cannot achieve, and sets standards for the public good. The main question is to find out what kind of regulations can best reduce the social gradient in obesity, and what is the cost of developing new regulations compared with the likely cost of the societal burden if obesity rates continue to escalate.

Participatory approaches

Community participation has been advocated as having the potential to make the delivery of services more effective and has been strongly recommended by the WHO in general and by specific WHO programmes such as the Healthy Cities initiative.[780] WHO has defined health promotion as having several key traits, including: the process of enabling people to increase control over and to improve their health; action to build a healthy public policy; the creation of supportive environments; and the development of personal skills for health in the context of a strengthened community.[781] Strategies need to involve users as partners, treat the researcher and researched as equal partners, through improved

consultation and service delivery outcomes so that services are appropriate, accessible and client-centred.[782] A healthy-eating programme in a low-income community in Birmingham, UK carried out a consultation process with researchers and participants as a first step to developing a whole-community approach to healthy eating. The consultation process made clear that there were important gaps between the professionals' and public's concerns about health and their interpretation and definition of issues. Low levels of consumption of fruit and vegetables were not considered a main issue for the community; whereas environment, housing, leisure facilities, drugs, parenting and coping skills and a lack of social connectedness were the main issues raised by participants from the community. These results confirm earlier conclusions from similar initiatives such as the SUPER Project (a nutrition health promotion project) which found that positive behaviour change needs to be supported by participatory approaches to effectively sharing and absorbing health information and, most importantly, city-wide collaboration involving sectors such as education, information, culture, trade, transport, distribution, industry and social services.[783]

In conclusion an ecological approach is required to promote health improvement, social justice and sustainable economic development by linking interventions in food, physical activity and healthy environments across all stages of the lifecycle. Macroeconomic and labour market policies, the encouragement of cultural values promoting equal opportunities and environmental hazard control on a national and international scale will contribute to reducing poverty and the wider adverse effects of inequality on society.[784]

6 Recommendations for developing the knowledge base

At several stages in this report we have noted the lack of adequate evidence and information on which to base interventions and policies. We have noted a lack of good quality evidence regarding the determinants of obesity and a severe lack of evidence on effective interventions.

This section considers gaps in the knowledge base and the measures that may be needed to fill these gaps. Given the wide-ranging nature of this report, this is neither a comprehensive list of recommendations nor an exhaustive review of the gaps that exist in current knowledge, but indicates the priority areas in need of attention.

Main findings

- There is a need for more evidence on the links between nutrition insecurity and obesity and the socio-economic differentials in the impact of the modern food supply.
- New EU dietary and physical activity guidelines are needed on how maternal and infant health and welfare services can best support disadvantaged reproductive-age women to maintain a healthy weight.
- There is a need for adequate monitoring of obesity levels, the determinants of obesity and the effects of interventions. Monitoring provide the basis for setting targets, including targets to reduce the social gradient in obesity.
- For policy makers to be able to invest in health promotion to reduce obesity levels, more evidence of the reach an penetration of interventions in lower income groups is needed. The cost of interventions also needs to be reported in order to estimate cost-effectiveness.

6.1 Food and nutrition insecurity

Investigations are urgently needed to assess the co-existence of obesity and food and nutrition insecurity (where fatty and sugary foods are abundant and affordable to all but micronutrient-rich foods are not) among individuals living in less-privileged areas. This will provide information to policy-makers and enable the definition of targets and highlight direction. As discussed earlier, health education campaigns alone appear not to be enough. Evaluations of health interventions should focus on how best to support food insecure individuals on low incomes to change their dietary and physical activity patterns.

Evaluation needs to be an integral part of each new intervention to reduce the increase in levels of obesity and determine effective progress in less-privileged groups. The next step could be to establish national and linked European databases (such as Closing the gap web-site http://www.health-inequalities.eu) of the results from evaluated interventions. Such a database could provide a forum for dissemination of information and provide an evidence base for best practice in different social settings.

The authors of this review found that there appears to be a dearth of evidence-based research and evaluation of interventions specifically relating to the association between obesity and food and nutrition insecurity. More research is required in this area in order to achieve a greater understanding and recognition by policy makers, service providers, NGOs and civil society.

6.2 Guidelines for health in the life course

The challenge to improve health through interventions during the life course, identified as one of the key strategic responses to health inequalities, will require reviewing the available guidance for health services and the provision of new EU guidelines on how maternal and infant health and welfare services can best support disadvantaged families.

6.2.1 Maternal weight gain in pregnancy

Women in lower SEGs may gain more weight during pregnancy than women in higher SEGs. In the USA, women with a family income less than 185% of the poverty line were about 2½ times more likely to have excessive weight gain during pregnancy than women with higher income.[785] Similar investigations should be carried out in Europe to find if poor women are more likely to experience excessive weight gain during pregnancy. Evidence suggests that the absence of professional advice concerning weight gain put women at risk of gaining too much weight during pregnancy.

A review of guidelines for weight gain is urgently needed. There is a striking absence of information on the adherence to weight gain recommendations among women during pregnancy. Indeed, there appears to be uncertainty concerning what appropriate guidelines should be used. Most European guidelines appear to be based on the Institute of Medicine (IOM) guidelines from the USA. However findings suggest that IOM guidelines may overestimate the recommended weight gain.[786] Therefore it is recommended that European guidelines should be updated with a view to reducing the recommended weight gain for overweight women during pregnancy. Professional bodies in Europe, such as Colleges of: Obstetrics and Gynaecology; Midwives; Nursing; and General Practitioners are recommended to develop, in collaboration with scientific experts in nutrition and physical activity, EU-wide guidelines for appropriate targets and management of weight gain before, during and after pregnancy. These guidelines should be user-friendly for both practitioners and women, especially those from less-privileged societies.

6.2.2 Infant and child health

Intelligence and behavioural skills determine economic and social success. Both are malleable at an early age and remedial actions for young people from less-privileged backgrounds become progressively more costly the later it is attempted. Early interventions are generally assumed to have much higher returns than later interventions, and this needs further elaboration to show how society should best invest in a child's early years and support for parents to maximise investment returns. There appears to be a dearth of evidence of interventions to prevent the development of overweight and obesity in pre-school children. Mothers in lower socio-economic groups tend to focus on surviving their daily life stresses and may use food to cope with these stresses. More investigations are needed into the effectiveness of interventions to promote healthy eating in preschool settings for children aged 1 to 5 years. Family-based studies are needed to consider the role of parents along with investigations into effective interventions that link both pre-school and home activities.

More research is needed into the nutritional needs of the brain and how cognitive and non-cognitive development are affected by poor diet, lack of physical activity and obesity. There is some empirical evidence suggesting that food and nutrition insecurity might co-exist alongside obesity in children living in less-privileged areas and so investigations are needed to look at clinical populations of obese children compared with representative samples of obese children in the general population. Quantitative and qualitative surveys

in low income areas are recommended to find out the degree to which obese children are nutrient deficient and what determines their eating and physical activity patterns.

6.2.3 Adults and older people

As noted in the first part of this section, there is a need to investigate the nature, extent and effects of widely-available energy-dense nutrient-poor foods – i.e. food and nutrition insecurity. The need to develop food and nutrition policies that protect health and contribute to socio-economic well-being has been endorsed by all European countries. The World Declaration and Plan of Action on Nutrition was adopted in 1992 and since then has been supported by over 30 resolutions of the World Health Assembly. This was followed by the full endorsement of the First and Second Action Plans for Food and Nutrition Policy at the WHO European Region in 2000 and 2007, and the Global Strategy on Diet and Physical Activity was adopted at the WHA in 2004 and the European Charter on Obesity in 2006 and the EU White Paper "*A strategy for Europe on Nutrition, Overweight and Obesity Related issues."* These international policy documents acknowledge that access to nutritionally adequate food is a right and nutritional well-being should be at the core of food, health, social and economic policies.

It is recommended that these commitments be incorporated into national health inequalities policies and national social inequalities (e.g. NAPs) policies, and resources need to be invested to establish the necessary coordination mechanisms to ensure that different government departments coordinate actions to address food and nutrition insecurity and obesity in disadvantaged groups. In the EU White paper on nutrition it is stated that: "*The Commission will set up a High Level Group focused on nutrition and physical activity related health issues. The objective of the Group would be to ensure that the exchange of policy ideas and practices between Member States takes place, with an overview of all government policies. Liaison with the EU Platform will enable fast communication between sectors, encouraging rapid exchange and uptake of public-private partnership approaches." "The Commission will collate and, together with the High Level Group, will assess these national and regional actions and make this information accessible from its web-site. The Commission intends to use the High Level Group in order to promote the dissemination of best practice as well as to provide any support which could be considered as appropriate at Community level*.

An example of the sort of research able to show how inter-departmental responsibilities interact has been provided by the UK government Foresight programme.[787] In the Foresight report it is stated "*The greater prevalence of obesity among poorer social groups implies that efforts to counter health inequalities must take account of obesity; conversely, action on obesity must take account of socioeconomic factors. Obesity is not exclusively a matter of social class and inequality. The suggestion that it is primarily a feature of lower-income groups would be to disguise the society-wide character of the epidemic. However, efforts to combat obesity in lower-income groups will have positive consequences for both health and inequality***"**

Support for cross-sectoral policy-making can be provided through techniques such as Health Impact Assessment, involving analytical methods combining scientific research and stakeholder participatory activities.[788] [789] These techniques themselves are in their infancy and would benefit from further investment.

6.3 Monitoring and Surveillance

As described earlier, the prevalence of obesity in some EU countries indicates a significant social gradient in health status between different socio-economic groups. Some countries appear to have no representative data on the prevalence of obesity by socio-economic group, using measured heights and weights. In addition the epidemic of childhood obesity is already present in most countries. The first step to evaluating the causative (and preventive) factors is to monitor trends in obesity, for example in school age children through the education system, with data collected annually.

The EU Commission 2007 White paper[790] *A Strategy for Europe on Nutrition, Overweight and Obesity Related Issues* states *"There is little harmonisation of the way that national data on obesity and overweight indicators is collected making comparison across the EU difficult. Furthermore, there is limited data in important areas such as food consumption. The Commission has identified the need to strengthen monitoring on three key levels. Firstly, at the macro level to ensure consistent, comparable data on overall progress indicators – within the context of the European Community Health Indicators (ECHI) – related to diet and physical activity such as the prevalence of obesity. Secondly, to systematically identify what actions are underway in the Member States so that these can be monitored and evaluated for impact. And thirdly, in relation to individual projects and programmes given their role as the building blocks for an effective societal response.*

To support macro level monitoring, the European Commission has developed a European Health Interview Survey (EHIS) which will become operational in 2007 and will put in place a harmonised approach to the regular collection through the European Statistical System (ESS) of statistical data on self-reported height and weigh, performance of physical activity and frequency of consumption of fruits and vegetables. By 2010, the Commission plans to establish a European Health Examination Survey (EHES) to obtain objective information on a range of nutrition measures including BMI, cholesterol and hypertension in a randomly selected population. EUROSTAT is also in the process of building a first set of food consumption indicators in order to monitor nutrition patterns and trends. The emphasis of these activities within the ESS is on developing quality data and indicators on health status (including obesity) as well as on lifestyles (including on nutrition and physical activity)."

If trends on obesity data are not available other data could be useful in providing relevant information concerning nutrition security throughout the life-course until data on obesity are available. The use of additional indicators can help to inform policy makers regarding the possible associations between obesity, food and nutrition insecurity and health status. Recommended indicators for different stages of the life-course include:

- Maternal and young child: weight before, during and after pregnancy by SEG; birth weight (low and high) and infant mortality by SEG; breastfeeding rates and feeding practices; and dental health by SEG.
- Children: dietary intake and physical activity behaviours and attitudes by SEG. In addition dental health and monitoring the intake of soft drinks should be a priority in order to make clear recommendations to those responsible for the management of schools, after-school institutions and leisure facilities.
- Adolescents: teenage pregnancy; dietary intake (e.g. fruit and vegetable); physical activity by SEG.

- Adults and older people: dietary intake (fruit and vegetable); physical activity; dental health; premature mortality rates from coronary heart disease; life expectancy by SEG.

In addition a range of indicators relevant to monitoring food and nutrition insecurity are suggested in the Review of the Scottish Diet Action Plan:[791]

- Food literacy: – dietary knowledge and beliefs, attitudes, motivation to change, cooking skills, food purchasing skills;
- Food culture – where food is bought, the context in which it is eaten and how much is consumed;
- Food access – the prices of basic healthy foods, the cost of basic food items relative to other essential expenditure, access to appropriate retailing and catering outlets;
- Food supply – where key foods come from, what is produced versus what is eaten, food imports versus exports.

Data collection and analysis of social inequalities in relation to dietary and physical activity behaviour is essential. The experience from the investigations in the UK carried out by the Food Standards Agency (FSA) and the Diet and Low Income Team will help in the development of new monitoring and surveillance indicators.[792] The FSA's Low Income Diet and Nutrition Survey found high levels of overweight and obesity among women and especially children in lower income households. Further analyses that could link obesity to specific dietary patterns may also be undertaken, for example to understand whether a high energy intake can co-exist with a low micro-nutrient intake.

Low income in itself does not necessarily reflect the complex interaction of factors associated with living in poverty including educational level, young motherhood, ethnicity, unemployment and family social and cultural norms. In some countries deprivation indices have been developed to include a range of these influencing factors. For example in Scotland, the Scottish Index of Multiple Deprivation[793] (SIMD) contains information relating to current income, employment, health, education skills and training, geographic access to services (including public transport), housing and crime.

In addition to recommending that data be collected, the methods to collect these need to be harmonized across Europe. For example as shown in earlier sections, social status is defined using income, education, occupation, living standard and/or social index, making accurate comparisons between countries impossible. It must be stressed that this reveals the paucity of data found while carrying out this review rather than the paucity of data that exist throughout Europe. Many countries probably have data that the authors were unable to access. However it does illustrate the difficulty that is experienced by the lack of central statistical sources available for this kind of evidence review. It is recommended that a separate review is undertaken by the EU along with Member States to establish a more comprehensive picture of existing national data regarding the prevalence of obesity and socio-economic groups.

In the meantime the data gathered for this review supports the following recommendations concerning further monitoring and surveillance:

- standardization is needed regarding how socio-economic groups are defined
- data are needed on the prevalence of obesity in women of reproductive age by social group

- data are needed on the prevalence of obesity in children and adolescents, especially teenage girls by social group
- body mass index (BMI) should be calculated from measured rather than self-reported heights and weights.

In addition to being used for target setting, an important role for monitoring population trends is to allow communities to assess their local interventions. School-based (via school health services) or local government-based monitoring programmes could measure, in a consistent manner, environmental and behavioural factors and this would speed-up the search for effective interventions. Schools regularly use bench-marking for literacy outcomes whereby their results are fed back and compared with other schools. If nutrition and physical activity data were to be used in a similar manner it could allow different schools to assess the impact of their efforts and stimulate the development of national targets.

6.4 Target setting

National indicators are needed to set targets, monitor trends and evaluate the effectiveness of different policies and interventions. In a review carried out by Crombie[794] only four countries had set specific targets regarding obesity in the general population (Table 6-1).

Table 6-1 Obesity targets

	Initial prevalence	Target prevalence by 2010
USA		
Adults at healthy weight	42%	60%
Obese adults	23%	15%
Overweight or obese children and adolescents	11%	5%
Japan		
Obese men (20-69 yr)	24%	15%
Obese women (40-69 yr)	25%	20%
Obese school children	11%	7%
Northern Ireland		
Obese men	17%	<17%
Obese women	20%	<20%
England		
Obese children		Halt the year on year rise in obesity in children under 11 years

Source: adapted from Crombie et al 2005

The USA set targets for adults who are at a healthy weight as well as to reduce the proportion who are obese. Japan set separate targets for children and men and women from age groups that have been shown to be at risk. Both have ambitious targets given the rate at which obesity is increasing. Northern Ireland's target is to halt the increase in the prevalence of obesity in adults. England's target, set in July 2004, was to halt the year on year rise in obesity among children under 11 years old by 2010 but this is superseded by a target to reduce child obesity to its 2000 levels by the year 2020.[795]

6.4.1 Inequalities targets

In earlier sections of this report the proportion of the obesity attributable to socio-economic status was described, showing that as much as 70% of female obesity may be due to SES inequalities.

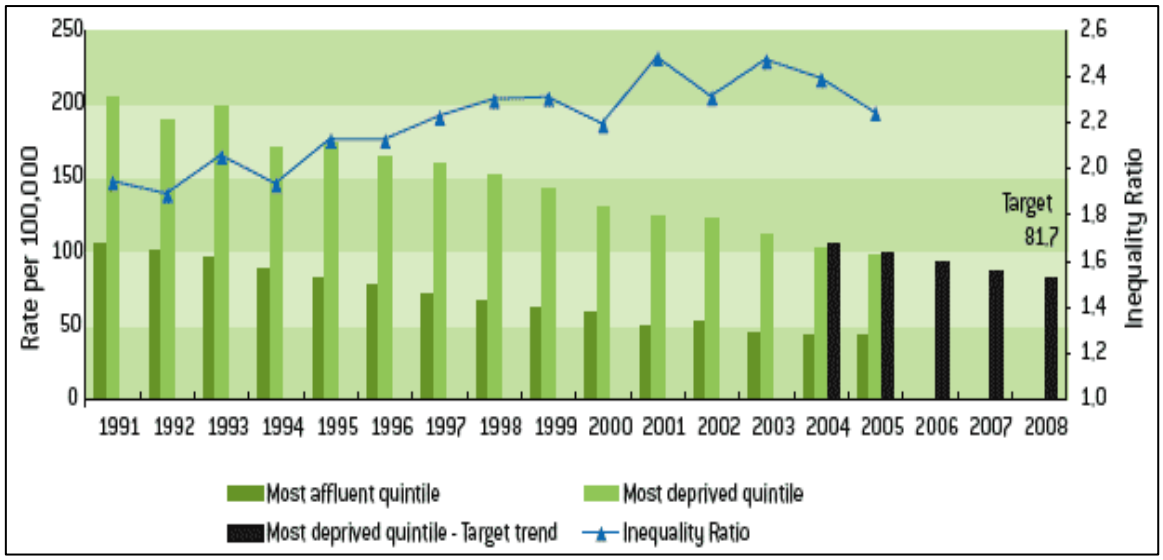
Table 6-2. Targets for reducing women's obesity attributable to SES differences.

Country (SES indicator)	Proportion of female obesity attributable to SES inequality	Reduction in the proportion of female obesity due to inequality by 25%
Belgium (education)	73%	44%
Denmark (education)	18%	13%
Estonia* (income) age 25-34	39%	29%
Finland (education)	25%	18%
France (standard of living)	41%	31%
Germany (SES index)	66%	50%
Greece (SES) age 20-39	56%	44%
Portugal (education)	71%	53%
Sweden (education)	39%	29%
UK England (income)	33%	25%

* Data for Estonia are for overweight (BMI >25)

Estimates can be used to set targets for reductions in obesity inequalities. Examples for several countries are shown in table 6-2. As an example, deaths from premature coronary heart disease have been used to evaluate trends in inequalities (see figure below). Similar targets to reduce by 25% by 2015 the percentage of obese reproductive-age women by most deprived quintile compared with most affluent quintile could be defined.

Figure 6-1. Coronary heart disease deaths in adults under 75y, by deprivation index.



Target: to reduce CHD mortality per 100,000 population in the most deprived groups from 112 in 2003 to 82 in 2008 (an average annual reduction of 6%). In the first 2 years the rate decreased by 13%. Although mortality rates in the most affluent areas also fell, the inequality gap narrowed.
Source: Scottish Executive, 2006 [796]

Further discussion is needed in Europe on how best to set targets and help reduce the social gradient in obesity, particularly in reproductive age women.

For example, several other options[797] could be considered for setting targets depending on the population rates of obesity in different countries:

1. Aim to decrease the number of people who have a high BMI by x% in order to bring down the prevalence of obesity in the general population e.g. in Scotland the overall population levels of obesity are high.

2. Target a reduction in the gap between highest and lowest groups, e.g. reduce the gap in the percentage with obesity between social groups by 10% e.g. in Germany where the prevalence due to inequality appears to be extremely high both in women (66%) and men (47%).

3. Aim to increase the proportion of people able to maintain their weight at current levels e.g. increase to x% the proportion of children in bottom quintile who maintain weight and do not gain weight e.g. in England where the target was to halt the year on year rise in obesity in children under 11 years.

4. Set specific targets by deprivation quintile, e.g. decrease the proportion of the population who are obese in the bottom quintile from x% to x minus 20% e.g. in Greece and Estonia aim to reduce the proportion of obese reproductive-age women, 56% and 13% respectively, living in less privileged groups by 20%.

In addition to setting targets regarding obesity levels, additional targets related to reducing food and nutrient insecurity and increasing access to physical activity should be considered. A range of interventions should then be linked to the national targets defined and evaluated for the effectiveness. Food and health policies in Europe need to adopt a more targeted approach and thus invest resources and carry out interventions within the most deprived areas while keeping an eye on the whole population. The implications of targets are considerable and priorities will vary in different countries.

6.4.2 Cost of food

Based on the evidence reviewed in this report it is recommended that research is needed to investigate the cost, access and availability of a healthy diet in less-privileged areas. This will help identify issues around food insecurity in low-income families where there is a high prevalence of obesity.

Economic instruments

Evidence of food price elasticity (i.e., how much demand for food responds to changes in price) is limited. However people, especially those with low incomes, may be encouraged to reduce consumption of unhealthy foods, if the price is higher, and eat more healthy foods, if the price is lower. Tax revenues generated from the sale of unhealthy foods could be used to subsidize the cost of healthy foods and health promotion programmes. Recommendations from WHO to policy-makers includes: supporting rigorously designed prospective research on the impact of selected economic instruments; and support assessments of consumer reaction, administrative costs and commercial food industry response.

Minimum income levels

Welfare payments should incorporate the cost of a healthy diet. Research needs to be carried out in each EU country to determine the costs of an adequate diet for an adult and a child. In order to determine the cost of healthy eating, data collection systems should be developed which allow for the ongoing assessment of what percentage (and absolute

amount) of disposable income is spent on food by SEG compared with the cost of an adequate diet. Evidence on the cost of a healthy diet should then be used to decide at what level the minimum income standards should be set. A Europe-wide programme to consider minimum income levels necessary in each country to ensure families can afford a culturally acceptable, nutritionally adequate diet is needed.

6.5 Investing in health

In the last decade there has been increasing interest in the suggestion that health promoting strategies should be considered as investments rather than as forms of medical intervention, including the new EU Health Strategy *'Together for Health: A Strategic Approach for the EU 2008-2013*'. In respect of obesity prevention, Hawe and Shiell [798] suggest that a package of interventions can be described in terms of an investment portfolio containing a mixture of 'safe' low-return savings schemes and 'risky' potentially high-return gambles.

In health promotion, a return on investment can be measured in terms of expected health gains and other desired outcomes. The risk can be measured in terms of the consistency of the impact of an intervention and indications of its likely effectiveness. This approach has been developed further by Swinburn and Gill [799] and Swinburn et al [800] who have described a portfolio 'promise' table in which the risk element is displayed in two dimensions: population impact (ranging from low to high) and certainty of having an effect (also ranging from low to high), and the resulting investment 'promise' ranging from least (low certainty, low impact) to most (high certainty, high impact). Thus intensive interventions within small groups or individuals might be low-risk, as they consistently result in changes in behaviour and other outcomes. However, the overall return may only be small to moderate as the effect of the intervention may be small and result in only a slight impact on the health status of the community as a whole.

The process for assessing and weighing up potential gains and risks permits the adoption of a mix of interventions, or a portfolio, to balance the risks as a way to maintain health promotion momentum without having complete evidence about the effectiveness of interventions. This approach allows the selection of interventions to be based on the best available evidence whilst not excluding untried but promising strategies.

The important point here is that investments require different types of information including costs, likely effectiveness, likely depth and reach of impact, sustainability and acceptability. These are the elements that are needed to assess the likely performance of an investment vehicle. In the present context, depth and reach of an intervention are highly significant factors – does the intervention reach lower socio-economic groups, does it affect all members of the group, and is the effect as strong as in other groups?

Although a primary concern to policy-makers and managers in public health, reach, depth and above all the costs of interventions are remarkably rarely discussed in the evaluations and systematic reviews. Information about costs are remarkably sparse: a recent review of workplace and community interventions noted that only two studies met the criteria for inclusion provided cost-effectiveness analyses of worksite interventions to prevent and control overweight and obesity.[801] For child obesity prevention there appears to be only one study which considered the costs of an intervention programme (the US Planet Health Program),[802] and this estimated that the intervention cost some $34,000 ($14 per student per year), and that the programme could expect to save an estimated $16,000 in medical care costs and $25,000 in loss of productivity, indicating a net saving of around $7,000 to

society. It is not clear if the costs of such a programme would be favourable where the intervention, productivity and medical costs may be different.

Analyses undertaken in Australia by the Victoria State Department of Human Services[803],[804] have estimated cost effectiveness of different types of intervention for child obesity, comparing costs (to the state) of interventions with the likely number of healthy years of life that would be saved (measured in DALYs – Disability-Adjusted Life Years). The findings indicate the likely superior cost benefits of controlling marketing to children and educational programmes focussing on avoiding high-calorie foods and drinks and TV watching, compared with some of the activity-related schemes.

Major investments may be required to create the conditions to tackle health inequalities. Unless reliable evidence of effectiveness is available, policy-makers may not have access to the correct advice on how best to reduce the existing social gradient in obesity within the European Union.

7 Abbreviations and Glossary

7.1 Abbreviations

EU-funded programmes relevant to this report:

DYNAMO-HIA: Dynamic Modelling for Health Impact Assessment. http://ec.europa.eu/phea/documents/2006_Health_Information.pdf.

EHN-CHOB: European Heart Network – Policy Options to prevent Child Obesity. www.ehnheart.org/content/goto.asp?docid=6392

EURO-PREVOB: European Consortium for the prevention of obesity through effective nutrition and physical activity actions. www.europrevob.eu/

EUROTHINE: Tackling Health Inequalities n Europe. http://mgzlx4.erasmusmc.nl/eurothine/

HELENA: Healthy Lifestyle in Europe by Nutrition in Adolescence : includes cross-sectional, crossover and pilot community intervention multi-centre studies. http://www.helenastudy.com/

HOPE: Health Promotion through Obesity Prevention in Europe. http://www.hopeproject.eu/

IDEFICS: Identification and prevention of **D**ietary- and lifestyle-induced health **EF**fects **I**n **C**hildren and infant**S.** http://www.ideficsstudy.eu/

PORGROW: Policy Options for Responding to the Growing Challenge of Obesity. See www.sussex.ac.uk/spru/porgrow

BEUC Bureau Européen des Unions des Consommateurs
BFHI Baby Friendly Hospital Initiative
BMI Body Mass Index
CAP Common Agriculture Policy
CMO Common Market Organisation
DALYs Disability-Adjusted Life Years
DMFT Decayed, missing or filled teeth
ECHI European Community Health Indicators
ECOHOST European Centre on Health of Societies in Transition
EHIS European Health Interview Survey
ESS European Statistical System
EHES European Health Examination Survey
EPIC European Prospective Investigation into Cancer and Nutrition
FAO Food and Agriculture Organisation
FSA Food Standards Agency
GDA Guideline Daily Amount
GDM Gestational Diabetes Mellitus
GDP Gross Domestic Product
HBSC Health Behaviour in School Aged Children
HIA Health impact assessment

HIAP Health in all policies
HIV Human immunodeficiency virus
HLYs Healthy Life Years
IQ Intelligence quotient
IOM Institute of Medicine, USA
IOTF International Obesity Task Force
LIDNS Low Income Diet and Nutrition Survey
LBW Low birthweight
NAPs National Action Plan against Poverty and Social Exclusion
NGOs Non-governmental Organisations
OMC Open Method of Coordination
PHEA Public Health Executive Agency
SES Socio-economic status
SEGs Socio-economic groups
SIMD Scottish Index of Multiple Deprivation
VAT Value added tax
WIC Welfare scheme for Women, Infants and Children
WHO World Health Organization

7.2 Glossary

Birthweight: The weight of a newborn baby. Abnormal weights are defined as:

Macrosomia: means a high birthweight infant that is large-for-gestational-age: e.g. term birthweight > 4000 grams.

Low birthweight: small for gestational age, e.g. term birthweight < 2500 grams.

Very low birthweight: very small for gestational age, e.g. term birthweight of < 1500 grams.

Body Mass Index: (BMI) weight in kilograms divided by the square of height in metres.

Disability-adjusted life years (DALYs):
A calculation of DALYs provides an estimate of disease burden in a population. It can be used to compare different determinants of ill-health - thus a statement that tobacco smoking causes 20% of DALYs is interpreted to mean that tobacco smoking causes 20% of the disease burden in the population, measured in terms of lost years of healthy life (lost as a consequence of ill health or early death).

Determinants of health:
These are factors that influence health positively or negatively. This report focuses on social, economic and lifestyle-related determinants of health – that is, factors that can be influenced by political, commercial and individual decisions – as opposed to age, sex and genetic factors, which also influence health but are not, on the whole, open to influence by political or other policies.

Determinants of social inequalities in health:
These are social, economic and lifestyle-related determinants of health that increase or decrease social inequalities in health. These factors can be influenced by political, commercial and individual choices/decisions.

Differences in health – Absolute:
This reflects the difference between the indicator value for the lowest and highest socio-economic group – for example, the excess of deaths due to a certain disease that occurs (per 100 000 population) in the disadvantaged group, as compared with the most privileged group.

Differences in health – Relative:
This reflects the ratio of the health-indicator value of the disadvantaged group to the corresponding value of the reference group. The relative difference is thus a measure of the increased risk of experiencing poor health in, for example, the lowest socio-economic group, as compared with the highest socio-economic group or the population as a whole as a proportion of the latter. Relative differences can also be stated in terms of a percentage.

Effectiveness:
How well an intervention works compared with a similar, non-intervention condition.

Efficacy:
Whether the intervention works in different settings and for different groups.

Efficiency:
A comparison of the cost of outcomes alongside other interventions.

Equity in health:
Equity in health implies that, ideally, everyone could attain their full health potential and that no one should be disadvantaged from achieving this because of their social position or other socially determined factors.

Ethnic differences in health:
Ethnic differences in health are systematic differences in health between different ethnic groups. Social inequalities in health should, whenever possible, be described and analysed by ethnic background in countries with marked ethnic diversity, as both the magnitude and causes of observed differences in health may differ by ethnic background within socio-economic groups. Conversely, descriptions and analyses of health by ethnic background should, whenever possible, be analysed by socio-economic background, to assess the magnitude of socio-economic differences in health within different ethnic groups.

Food access:
Food access is having the ability and capacity to obtain the foods necessary for a healthy diet.

Food availability:
Food availability pertains to the production, physical presence, or supply of food items on the market.

Food security:
Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

Food and nutrition security:
Food and nutrition security emphasizes that food contains important elements in addition to energy. Thus availability and access to a diet of relatively unprocessed foods, rich in vitamins, minerals, anti-oxidants, phyto-chemicals and other essential nutrients, should be assured for all vulnerable groups. For example obese children, especially those living in some low income families, may be eating too much energy from foods high in fat and sugar but at the same time their diets may be deficient in nutrients and other elements found in unprocessed foods that are essential for normal growth and brain development.

Gender differences in health:
Gender differences in health are economically, socially or culturally determined systematic differences in health between men and women – in contrast to biological differences between the

sexes. Social inequalities in health should, whenever possible, be described and analysed separately for men and for women, as both the magnitude and causes of observed differences may vary between the two genders. Conversely, gender differences in health should be considered according to socio-economic background.

Gestational weight gain: weight gained during pregnancy.

Gini coefficient and Gini index:
The Gini coefficient is a measure of inequality of income distribution or inequality of wealth distribution in a population, usually a national state. It takes a value between zero and one. A low Gini coefficient indicates more equal income or wealth distribution, while a high Gini coefficient indicates more unequal distribution. A Gini coefficient of zero corresponds to perfect equality (e.g. everyone has the same income) and a coefficient of one corresponds to perfect inequality (e.g. one person has all the income, while everyone else has no income). The Gini index is the Gini coefficient expressed as a percentage and is equal to the Gini coefficient multiplied by 100. Values for the Gini coefficient for countries around the world can be found in the annual UN Human Development Report.

Health divide and **Health gap**: These terms are used interchangeably with the phrase social inequalities in health.

Healthy life years (HLYs):
HLYs provide an estimate of population health similar to life expectancy but adjusted for years lost due to disability, i.e. they indicate the number of years that a person of a certain age can expect to live without ill-health. It is based on length of life (measured with mortality tables) weighted by quality of life (measured by self-perceived disability assessed by health surveys) and is thus suitable for situations where exact disease statistics are not available. HLYs are a measure currently used by the European Commission and form part of the assessment of the socio-economic wellbeing of the Community under the Lisbon Agenda.

Intelligence quotient (**IQ):**
Intelligence quotient is a score derived from one of several different standardized tests attempting to measure intelligence. IQ tests are used as predictors of educational achievement. People with low IQ scores are sometimes placed in special-needs education.

Lactation failure: mothers are unable to continue breastfeeding.

Life Course: a term used in social epidemiology to describe the accumulation of material, social and biological advantages and disadvantages during a lifetime.

Macrosomia: see **Birthweight.**

MONICA (Multinational MONItoring of trends and determinants in CArdiovascular disease): project was established in the early 1980s in many Centres around the world to monitor

trends in cardiovascular diseases, and to relate these to risk factor changes in the population over a ten year period. It was set up to explain the diverse trends in cardiovascular disease mortality which were observed from the 1970s onwards.

Nutrition security: see **Food security.**

Population attributable fraction: The proportion of the prevalence of a disease which can be attributed to a specific aspect of the population. In the present report it is used to estimate the proportion of obesity prevalence attributable to social inequalities. It is calculated as the difference between the prevalence of obesity in the highest socio-economic group and the prevalence in the whole population, divided by the prevalence in the whole population and expressed as a percentage.

Post-partum: after delivery or birth of an infant.

Public procurement:
Public procurement is the term used to describe the purchasing of works, supplies and services by national, regional and local public bodies, including central government, local authorities, fire and police authorities, defence, health services, joint consortia of public bodies, and public and private utilities. Throughout Europe, the public sector and utilities need to purchase goods and services for a huge range of activities and the annual value amounts to around £500 billion, estimated at around 11.5% of EU Gross national product.

Social inequalities in health:
Social inequalities in health are systematic differences in health status between socio-economic groups, as measured by income, education and occupation. All systematic social inequalities are socially produced, modifiable and unfair. (WHO 2006)

Social gradient in health:
Social gradient in health refers to the improvement in health status seen with improvements in socio-economic status. This concept illustrates the gradient across society, and not just a gap between those having poor health at the lower social status extreme and those in good health at the other. A social gradient is found for most common diseases.

Socially marginalised people:
The socially marginalized include homeless people, alcohol and drug abusers, refugee populations, ethnic minorities, people with mental disorders and prostitutes.

8 References

[1] Roskam A-JR, Kunst AE. Overview of inequalitties in overweight and obesity across Europe. Chapter 23 in Tackling Health Inequalities in Europe: an Integrated Approach. Eurothine Final Report. Rotterdam: Erasmus University Medical Centre, 2007. http://mgzlx4.erasmusmc.nl/eurothine/uploads/eurothine_final_report_complete.zip, accessed 26 Oct 2007.

[2] Budewig K, et al. Why Diets, Doctors and Denials Won't Work. Obesity Scotland, 2004. www.obesescotland.org.uk accessed 5 June 2007

[3] Obesity: Preventing and managing the global epidemic. Report of a WHO consultation on obesity. WHO Technical Report Series, 894. 2000.

[4] Cole, T., et al. Establishing a standard definition for childhood overweight and obesity worldwide: international survey. British Medical Journal 2000, 320:1240-1243.

[5] Silventoinen, K., et al. Trends in obesity and energy supply in the WHO MONICA Project. International Journal of Obesity and Related Metabolic Disorders 2004, 28(5):710-718.

[6] http://ec.europa.eu/comm/health/ph_determinants/life_style/nutrition/documents/iotf_en.pdf

[7] Jackson-Leach, R. and T. Lobstein, Estimated burden of paediatric obesity and comorbidities in Europe. Part 1. The increase in the prevalence of child obesity in Europe is itself increasing. International Journal of Pediatric Obesity 2006, 1:26-32.

[8] Jackson-Leach and Lobstein. Ibid.

[9] Jackson-Leach and Lobstein. Ibid.

[10] Department of Health. Health Survey for England 2003. 2004, The Stationery Office: London.

[11] Martinez, J.A., et al. Variables independently associated with self-reported obesity in the European Union. Public Health Nutrition, 1999, 2(1A):125-133.

[12] Molarius, A, et al. Educational level, relative body weight, and changes in their association over 10 years: an international perspective from the WHO MONICA Project. American Journal of Public Health. 2000, 90(8):1260-8.

[13] Cavelaars, A, et al. Socio-economic differences in risk factors for morbidity and mortality in the European Community. Journal of Health Psychology 1997, 2(3):353–372.

[14] Roskam A-JR, Kunst AE. Overview of inequalitties in overweight and obesity across Europe. Chapter 23 in Tackling Health Inequalities in Europe: an Integrated Approach. Eurothine Final Report. Rotterdam: Erasmus University Medical Centre, 2007. http://mgzlx4.erasmusmc.nl/eurothine/uploads/eurothine_final_report_complete.zip, accessed 26 Oct 2007.

[15] Stam-Moraga, M., et al. Sociodemographic and nutritional determinants of obesity in Belgium. International Journal of Obesity and Related Metabolic Disorders 1999, 23(Suppl 1):1-9.

[16] Enquête Santé 2004 (Belgian Health Interview Survey conducted 2004) online database (http://www.iph.fgov.be/epidemio/hisia/index.htm, accessed 3 April 2007), ISP (Scientific Institute of Public Health).

[17] Stam-Moraga, M., et al. Sociodemographic and nutritional determinants of obesity in Belgium. International Journal of Obesity and Related Metabolic Disorders 1999, 23(Suppl 1):1-9.

[18] The National Health Interview Survey 2005, Denmark (Sundheds- og sygelighedsundersøgelsen 2005 (SUSY-2005)). (http://www.si-folkesundhed.dk/Forskning/Befolkningens%20sundhedstilstand/SUSY.aspx, accessed March 2007).

[19] Tervise Arengu Instituut (National Institute for Health Development), Eesti Taiskasvanud Rahvastiku Tervisekaitumise Uuring 2004 (Health Behaviour Survey of Estonian Adults 2004), Tallinn, 2005.

[20] Lahti-Koski, M, et al. Age, education and occupation as determinants of trends in body mass index in Finland from 1982 to 1997, International Journal of Obesity and Related Metabolic Disorders, 2000, 24(12):1669-76.

[21] Borg, P and Fogelholm, M. Policy options for responding to growing threat of obesity (PoRGrow) Finnish national report. 2006, UKK Institute for Health Promotion Research: Helsinki. (http://www.sussex.ac.uk/spru/documents/finland_english.pdf, accessed 3 April 2007).

[22] L'obésité en France: les écarts entre catégories sociales s'accroissent, INSEE Premiere 1123. 2007, L'Institut national de la statistique et des études économiques (INSEE).

[23] Darmon N. personal communication. Data derived from Charles MA, Basdevant A, Eschwege E. Prévalence de l'obésité de l'adulte en France. La situation en 2000. A partir des résultats des études OBEPI. Ann Endocrinol 2002; 63, 154-158. and INSERM, TNS Sofres, Roche. OBEPI: enquête épidémiologique nationale sur le surpoids et l'obésité. 2006. http://www.roche.fr/portal/eipf/france/rochefr/institutionnel/lesurpoidsenfrance .

[24] Romon, M., et al. Influence of social class on time trends in BMI distribution in 5-year old French children from 1989 to 1999, International Journal of Obesity 2005, 29:54-59.

[25] De Peretti, C and Castetbon, K. Surpoids et obésité chez les adolescents scolarisés en classe de troisième. Etudes et Résultats, no 283, janvier, DREES. 2004.

[26] Heineck, G. Height and weight in Germany, evidence from the German Socio-Economic Panel, 2002, Economics and Human Biology 2006, 4(3):359-82.

[27] Helmert U. [Individual risk factors, health behaviour and mortality developments in Germany from 1984 to 1998] Gesundheitswesen 2003; 65:542-7.

[28] Kuepper-Nybelen J, et al. Major differences in prevalence of overweight according to nationality in preschool children living in Germany: determinants and public health implications. Archives of Diseases in Childhood, 2005, 90(4):359-63.

[29] Trichopoulos D, et al. The Health of Greeks: Today and Tomorrow. Proceedings of the Greek Academy, Athens 2003, 78:83-98.

[30] Trichopoulou A, et al. Mediterranean diet in relation to body mass index and waist-to-hip ratio: the Greek European Prospective Investigation into Cancer and Nutrition Study. American Journal of Clinical Nutrition 2005, 82(5):935-40.

[31] Manios Y, et al. Implication of socio-economic status on the prevalence of overweight and obesity in Greek adults: the ATTICA Study. Health Policy 2005, 74:224-232.

[32] Athyros, V., et al. The prevalence of the metabolic syndrome in Greece: the MetS-Greece Multicentre Study. Diabetes, Obesity and Metabolism 2005, 7:397-405.

[33] Horváth, Z., M. Pankotai, and I. Szabolcs, Policy options for responding to the growing challenge from obesity: stakeholder views in Hungary. Hungarian national report. Semmelweis University, Budapest, 2006. (http://www.sussex.ac.uk/spru/documents/hungary_english.pdf, accessed 3 April 2007). 2006.

[34] Prókai, A., et al. Differences in BMI of Hungarian Schoolchildren: 1980-2005 Faculty of Physical Education and Sports Sciences, Semmelweis University Budapest, Hungary.

[35] http://www.istat.it/dati/catalogo/20051118_00/inf0525stili_di_vita_condizioni_salute03.pdf

[36] Lifestyle Survey 2003, National Statistical Office: Malta.

[37] Lifestyle Survey, Ibid.

[38] Lifestyle Survey, Ibid.

[39] Visscher TLS, Kromhout D, Seidell JC. Long-term and recent time trends in the prevalence of obesity among Dutch men and women. Int J Obes 2002;26:1218-1224.

[40] Visscher et al, Ibid.

[41] Tverdal, A., [Prevalence of obesity among persons aged 40-42 years in two periods]. Tidsskr Nor Laegeforen 2001, 121(6):667-72.

[42] Kumar, B., et al. Ethnic differences in obesity among immigrants from developing countries, in Oslo, Norway International Journal of Obesity (London), 2006, 30(4):684-90.

[43] Marques-Vidal, V. and C. Dias, Trends in overweight and obesity in Portugal: The National Health Surveys 1995-6 and 1998-9. Obesity Research, 2005, 13:1141-45.

[44] Szponar, L., et al. Policy options for responding to the growing challenge from obesity: a cross-national comparative study. Polish National Report. Instytut Zywności i Zywienia, Warsaw, 2006.

[45] Dennis BH, Pajak A, Pardo B, Davis CE, Williams OD, Piotrowski W. Weight gain and its correlates in Poland between 1983 and 1993. Int J Obes 2000;24(11):1507-13.

[46] Szponar et al Ibid.

[47] Jahns L et al. Obesity, diet, and poverty: trends in the Russian transition to market economy. Eur J Clin Nutr. 2003;57(10):1295-302

[48] Wang, Y et al. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. American Journal of Clinical Nutrition, 2002, 75(6):971-977.

[49] Gutierrez-Fisac, J.L., et al. The size of obesity differences associated with educational level in Spain, 1987 and 1995/97. Journal of Epidemiology and Community Health, 2002, 56(6):457-460.

[50] Serra Majem, L., et al. [Childhood and adolescent obesity in Spain. Results of the enKid study (1998-2000)]. Med Clin (Barc), 2003, 121(19):725-32.

[51] Statistiska Centralbyrån (SCB), Sweden. Personal communication (Liselotte Schafer Elinde, May 2007).

[52] Department of Health. Health Survey for England 2003. 2004, The Stationery Office: London.

[53] Shaw, A., A. McMunn, and J. Field, The Scottish Health Survey 1998. 2000, The Scottish Executive Health Department.

[54] The Scottish Health Survey 2003, The Scottish Office. Online data (http://www.scotpho.org.uk/web/site/home/Clinicalriskfactors/Obesity/obesity_data/obesity_socialclass.asp accessed 3 April 2007).

[55] Welsh Health Survey: October 2003–March 2004. First Release: SDR 82/2004. 18 November 2004, National Assembly for Wales: Statistical Directorate.

[56] Department of Health. Health Survey for England 2003. 2004, The Stationery Office: London.

[57] The Scottish Health Survey 2003. Summary of Key Findings. (http://www.scotland.gov.uk/Resource/Doc/924/0019811.pdf accessed 3 April 2007). 2005, The Scottish Office: Edinburgh.

[58] Department of Health. Health Survey for England 2003. 2004, The Stationery Office: London.

[59] Stamatakis, E., et al. Overweight and obesity trends from 1974 to 2003 in English children: what is the role of socioeconomic factors? Arch Dis Child, 2005, 90(10):999-1004.

[60] Health Survey for England 1999 - Joint Health Surveys Unit of National Centre for Social Research, Department of Epidemiology and Public Health at the Royal Free and University College Medical School. Health Survey for England 1999, 2000, The Stationery Office: London.

[61] Office of the Chief Statistician Scottish Index of Multiple Deprivation 2004 Summary technical report, Scottish Office, Edinburgh, 2004, modified April 2006. http://www.scotland.gov.uk/Resource/Doc/47251/0027011.pdf, accessed 6 May 2007.

[62] Scottish Centre for Social Research, the National Centre for Social Research, the Department of Epidemiology and Public Health at University College London, and the MRC Social and Public Health Sciences Unit at the University of Glasgow. Scottish Health Survey 1995, 1998, 2003. Scottish Public Health Observatory. http://www.scotpho.org.uk/web/site/home/resources/OverviewofKeyDataSources/Surveys/cross_sectional/surveys_shes.asp, accessed 6 May 2007.

[63] Ezzati, M., et al. Rethinking the "diseases of affluence" paradigm: global patterns of nutritional risks in relation to economic development. PLoS Med, 2005, 2(5):e133.

[64] Pickett, K.E.et al. Wider income gaps, wider waistbands? An ecological study of obesity and income inequality. Journal of Epidemiology and Community Health, 2005, 59(8): p 670-4.

[65] World Health Organization Regional Office for Europe, The European health report 2005. Public health action for healthier children and populations. 2005, World Health Organization Regional Office for Europe: Copenhagen.

[66] Goodman, E., et al. Impact of objective and subjective social status on obesity in a biracial cohort of adolescents. Obesity Research, 2003, 11(8):1018-1026.

[67] Hardeman, W., et al. Interventions to prevent weight gain: a systematic review of psychological models and behaviour change methods. International Journal of Obesity and Related Metabolic Disorders, 2000, 24(2):131-43.

[68] Martinez, J.A., et al. Variables independently associated with self-reported obesity in the European Union. Public Health Nutrition, 1999, 2(1A):125-133.

[69] Roskam A-JR, Kunst AE. Overview of inequalitties in overweight and obesity across Europe. Chapter 23 in Tackling Health Inequalities in Europe: an Integrated Approach. Eurothine Final Report. Rotterdam: Erasmus University Medical Centre, 2007.

http://mgzlx4.erasmusmc.nl/eurothine/uploads/eurothine_final_report_complete.zip, accessed 26 Oct 2007.

[70] Mackenbach JP, Health inequalities: Europe in profile. An independent expert report commissioned by and published under the auspices of the UK Presidency of the European Union 2005 http://www.fco.gov.uk/Files/kfile/HI_EU_Profile,0.pdf accessed 7 October 2007.

[71] Mackenbach JP et al. Socioeconomic inequalities in health in Europe. In: Mackenbach J, Bakker M, eds. *Reducing inequalities in health: a European perspective*. London: Routledge: 2002: 3–24

[72] Marmot M. *The status syndrome: how social standing affects our health and longevity.* London, Bloomsbury Publishing Plc. 2004.

[73] Vågerö D & Eriksson R, Socioeconomic inequalities in morbidity and mortality in Western Europe. Lancet 1997: 350(9076): 516-518.

[74] Dahlgren G, Whitehead M (2007). European strategies for tackling social inequities in health: Levelling up Part 2. Copenhagen, WHO Regional Office for Europe (Studies on social and economic determinants of population health, No. 3). http://www.euro.who.int/document/e89384.pdf accessed 7 October 2007.

[75] Wilkinson RG, the impact of inequality: how to make sick societies healthier. London Routledge 2005.

[76] Costa G. et al., Italian case study. In: Health for all? A critical study of policies in seven European countries. Hogstedt C. Backlans M. Lundgren B. Moberg H. (eds) Stockholm, National Institute of Health 2006.

[77] The 2005 Public Health Policy Report. Report No.: R2005:44. Stockholm: Swedish National Institute of Public Health, 2005.

[78] McKee, M. and R. Raine, Choosing health? First choose your philosophy. The Lancet, 2005, 365:369-371.

[79] Swinburn, B et al. Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. Preventive Medicine 1999, 29(6 Pt 1):563-570.

[80] Dahlgren, G. and Whitehead, M. Levelling up (part 2): a discussion paper on European strategies for tackling social inequities in health, WHO Regional Office for Europe 2006.

[81] World Health Organization and Food and Agriculture Organization, Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert Consultation (WHO Technical Report Series 916). 2003, World Health Organization: Geneva.

[82] James, W., et al. Global strategies to prevent childhood obesity: Forging a societal plan that works. International Obesity TaskForce. A discussion paper prepared for the Global Prevention Alliance, McGill Integrative Health Challenge. October 26-27 2006. International Association for the Study of Obesity. 2006.

[83] Burns C. A Review of the literature describing the link between poverty, food insecurity and obesity with specific reference to Australia www.vichealth.vic.gov.au 2004 accessed 31 May 2007.

[84] Drewnowski, A and Spector, SE. Poverty and obesity: the role of energy density and energy costs. American Journal of Clinical Nutrition 2004; 79:6-16.

[85] Sarlio-Lahteenkorva, S., and E. Lahelma. Food insecurity is associated with past and present economic disadvantage and body mass index. Journal of Nutrition 2001,131: 2880-4.

[86] Wardle, J., J. Waller, and M.J. Jarvis. Sex differences in the association of socioeconomic status with obesity. American Journal of Public Health 2002, 92: 1299-1304

[87] http://ec.europa.eu/health/ph_publication/eb_food_en.pdf accessed 7 October 2007.

[88] Batty, G., I. Deary, and S. Macintyre, Childhood IQ in relation to risk factors for premature mortality in middle-aged persons: the Aberdeen Children of the 1950s study. JECH 2007, 61:241-247.

[89] Maes, H.H et al. Genetic and environmental factors in relative body weight and human adiposity. Behavior Genetics, 1997, 27(4):325-351.

[90] Selwitz RH, et al. Dental caries. Lancet, 2007; 369: 51–59

[91]Eurobaramoter Health and Food study 2006 http://ec.europa.eu/health/ph_publication/eb_food_en.pdf accessed 7 October 2007.

[92] Lennernäs M, Fjellström C, Becker W, Giachetti I, Schmitt A, Remaut de Winter AM, et al. Influences on food choice perceived to be important by nationally-representative samples of adults in the European Union. European Journal of Clinical Nutrition 1997;51(Suppl 2):8-15.

[93] Robertson, A., et al. Food and health in Europe: a new basis for action. 2004, Copenhagen: World Health Organization Regional Office for Europe.

[94] Leather, S., The Making of Modern Malnutrition: An overview of food poverty in the UK. The Caroline Walker Lecture 1996. 1996, The Caroline Walker Trust: London.

[95] Conway, J. et al. Prescription for Poor Health: The crisis for homeless families. 1988, The London Food Commission, The Maternity Alliance, SHAC and Shelter: London.

[96] Friel S, Harrington J, Thunhurst C, Kirby A, McElroy B. An unequal State: affordability and availability of policy recommended dietary intake on the island of Ireland JECH (in press).

[97] The Food Commission. The cost of food, in The Food Magazine. 2001.21.

[98] Leather, S., The Making of Modern Malnutrition: An overview of food poverty in the UK. The Caroline Walker Lecture 1996. 1996, The Caroline Walker Trust: London.

[99] Dowler, E., Inequalities in diet and physical activity in Europe. Public Health Nutrition, 2001, 4(2B):701-709.

[100] Drewnowski, A, Darmon, N. The economics of obesity: dietary energy density and energy cost. American Journal of Clinical Nutrition, 2005, 82(1 Suppl):265S-273S.

[101] Drewnowski A, Darmon N, Briend A. Replacing fats and sweets with vegetables and fruits--a question of cost. American Journal of Public Health. 2004 Sep;94(9):1555-9.

[102] Drewnowski, A, Darmon N. Food choices and diet costs: an economic analysis. J Nutr, 2005, 135(4):900-904.

[103] Popkin, B.M., K. Duffey, and P. Gordon-Larsen, Environmental influences on food choice, physical activity and energy balance. Physiology and Behavior, 2005, 86(5):603-613.

[104] Going hungry: The struggle to eat healthily on a low income. 2004. http://www.nch.org.uk/downloads/going_hungrymainreport2.pdf accessed on 31 May 2007.

[105] Robertson A., Social Inequalities and the burden of food-related ill-health. Public Health Nutrition. 2001, 4(6A), 1371-1373.

[106] Europe in Figures – Eurostat yearbook 2006-07. http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1073,46587259&_dad=portal&_schema=PORTAL&p_product_code=KS-CD-06-001

[107] Macdonald, L et al. Neighbourhood fast food environment and area deprivation – substitution or concentration? Appetite, 2007, doi:10.1016/j.appet.2006.11.004.

[108] Cummins, S., L. McKay, and S. MacIntyre, McDonald's restaurants and neighborhood deprivation in Scotland and England. American Journal of Preventive Medicine, 2005, 29(4):308-10.

[109] Lobstein, T. and S. Dibb, Evidence of a possible link between obesogenic food advertising and child overweight. Obesity Reviews, 2005, 6(3):203-208.

[110] World Health Organization and Food and Agriculture Organization, Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert Consultation (WHO Technical Report Series 916). 2003, World Health Organization: Geneva.

[111] Consumers Inernational, Easy targets. A Survey of television food and toy advertising to children in four Central European Countries (http://www.consumersinternational.org/Shared_ASP_Files/UploadedFiles/1B3F79A5-75D1-49F3-BE9E-4B2F9D10EA70_Doc75.pdf, accessed 7 January 2007). 1999, Consumers International: London.

[112] Roos, E., et al. Modern and healthy?: socioeconomic differences in the quality of diet. Eur J Clin Nutr, 1996, 50(11):753-760.

[113] Irala-Estevez, J., et al. A systematic review of socio-economic differences in food habits in Europe: consumption of fruit and vegetables. Eur J Clin Nutr, 2000, 54(9):706-714.

[114] Hulshof, K.F., et al. Socio-economic status, dietary intake and 10 y trends: the Dutch National Food Consumption Survey. Eur J Clin Nutr, 2003, 57(1):128-137.

[115] Roos, G., et al. Disparities in vegetable and fruit consumption: European cases from the north to the south. Public Health Nutrition, 2001, 4(1):35-43.

[116] Friel S and C. Conlon Food Poverty and Policy Ireland 2004 http://www.cpa.ie/publications/FoodPovertyAndPolicy_2004.pdf accessed on 31 May 2007.

[117] Malik, V., et al. Intake of sugar-sweetened beverages and weight gain: a systematic review. American Journal of Public Health, 2006, 84, 274-88.

[118] Cullen KW et al. Intake of soft drinks, fruit-flavored beverages, and fruits and vegetables by children in grades 4 through 6. American Journal of Public Health, 2002, 92(9):1475-8

[119] Nelson M, et al. *Low income diet and nutrition survey.* London: Food Standards Agency, 2007.

[120] Gregory J, Lowe S. *National Diet and Nutrition Survey: young people aged 4 to 18 years.* London, The Stationery Office, 2000.

[121] Wannamethee SG, Shaper AG. Alcohol, body weight and weight gain in middle-aged men. American Journal of Clinical Nutrition, 2003, 77:1312–1317.

[122] Scottish Executive. The Scottish Health Survey 2003. Scottish Executive, Edinburgh, 2005.

[123] Dowler, E., Inequalities in diet and physical activity in Europe. Public Health Nutrition, 2001, 4(2B):701-709.

[124] Popkin, B.M et al. Environmental influences on food choice, physical activity and energy balance. Physiology and Behavior, 2005, 86(5):603-613.

[125] Popkin. Ibid.

[126] Estabrooks, P.A., R.E. Lee, and N.C. Gyurcsik, Resources for physical activity participation: does availability and accessibility differ by neighborhood socioeconomic status? Annals of Behavioral Medicine, 2003, 25(2):100-4.

[127] McNeill, L., M. Kreuter, and S. Subramanian, Social environment and physical activity: a review of concepts and evidence. Social Science and Medicine, 2006, 63:1011-1022.

[128] Marmot, M. and R. Wilkinson, Social determinants of health. 2nd ed. 2005, Oxford: Oxford University Press.

[129] Eurobarometer on Physical Activity 2003. http://ec.europa.eu/health/ph_determinants/life_style/nutrition/documents/ebs_183_6_en.pdf

[130] The Eurobarometer on Health and Food 2006. .http://europa.eu.int/comm/health/ph_publication/eurobarometers_en.htm

[131] Dowler, E., Inequalities in diet and physical activity in Europe. Public Health Nutrition, 2001, 4(2B):701-709.

[132] Coggins, A D et al Physical activity and inequalities. A briefing paper. 1999, Health Education Authority: London.

[133] Brownell, K. and C. Fairburn, Psychosocial consequences of obesity, in Eating Disorders and Obesity: A Comprehensive Handbook, A. Stunkard and J. Sobal, Editors. 1995, Guilford Press: New York.

[134] Stunkard, A. and T. Wadden, Psychological aspects of human obesity. In: Obesity, P. Bjorntorp and B. Brodoff, Editors. 1992, Lippincott: Philadelphia.

[135] Rand, C. and A. Macgregor, Morbidly obese patients' perceptions of social discrimination before and after surgery for obesity. South Medical Journal, 1990. 83:1390-1395.

[136] Crandall, C. and M. Biernat, The ideology of anti-fat attitudes. J Appl Soc Psychol, 1990. 20:227-243.

[137] Stunkard, A. and T. Wadden, Psychological aspects of human obesity. In: Obesity, P. Bjorntorp and B. Brodoff, Editors. 1992, Lippincott: Philadelphia.

[138] Lissau, I. and T. Sorensen, Parental neglect during childhood and increased risk of obesity in young adulthood. Lancet, 1994, 343:324-327.

[139] Department of Health. Choosing Health: Making healthy choices easier. London, The Stationery Office, 2004.

[140] Drever, F. and M. Whitehead, Health Inequalities. 1997, London: The Stationery Office.

[141] Blane, D., The Life course, the social gradient and health, in Social Determinants of Health 2nd ed, M. Marmot and R. Wilkinson, Editors. 2006.

[142] Kallen, K., Maternal smoking, BMI and neural tube defects. American Journal of Epidemiology, 1998, 147(12):1103-11.

[143] Wamala, S et al. Womens exposure to early and later socioeconomic disadvantage and coronary heart disease risk: the Stockholm Female Coronary Risk Study. International Journal of Epidemiology, 2001, 30:275-84.

[144] Lawlor, D et al. Socioeconomic position in childhood and adulthood and insulin resistance. British Medical Journal, 2002, 325:805-810.

[145] Barker, D. Mothers, babies and disease later in life. 1994, London: BMJ Publishing

[146] Marmot, M. and M. Wadsworth. Fetal and early childhood environment: long-term health implications. Br Med Bull, 1997, 53(1).

[147] Batty, G et al. Childhood IQ in relation to risk factors for premature mortality in middle-aged persons: the Aberdeen Children of the 1950s study. JECH 2007, 61:241-247.

[148] ACC/SCN (Commission on the Nutrition Challenges of the 21st Century. Ending Malnutrition by 2020: an Agenda for Change in the Millenium. Final Report to the ACC/SCN, February 2000. United Nations Standing Committee on Nutrition, 2000. http://www.unsystem.org/scn/Publications/UN_Report.PDF).

[149] Laitenen, J et al. Family social class, maternal body mass index, childhood body mass index and age at menarche as predictors of adult obesity. American Journal of Clinical Nutrition, 2001, 74: 287-94.

[150] Townsend, M.S., et al. Food insecurity is positively related to overweight in women. J Nutr, 2001, 131(1738–1745).

[151] Kramer, M., et al. Socioeconomic disparities in pregnancy outcome: why do the poor fare so poorly? Paediatric and Perin Epi, 2000, 14: 194-210.

[152] Maternal Anthropometry and Pregnancy Outcomes. A WHO Collaborative Study. Bulletin of the World Health Organization, 1995, 73 Suppl.

[153] Wilkinson, P., et al. Teenage conceptions, abortions, and births in England, 1994–2003, and the national teenage pregnancy strategy. Lancet 2006, 368 (9550):1879-1886.

[154] Sukalich, S et al. Obstetric outcomes in overweight and obese adolescents. American Journal of Obstetrics and Gynecology 2006, 195: 851-5.

[155] Astrup, A., Healthy lifestyles in Europe; prevention of obesity and type II diabetes by diet and physical activity. Public Health Nutrition, 2001, 4(2B):499-515.

[156] Ramsay, S., et al. The relations of body composition and adiposity measures to ill health and physical disability in elderly men. American Journal of Epidemiology, 2006, 164(5):459-69.

[157] Heslehurst, N. et al. Trends in maternal obesity incidence rates, demographic predictors, and health inequalities in 36,821 women over a 15-year period. BJOG, 2007, 114(2):187-94.

[158] Villamor, E. and S. Cnattingius. Interpregnancy weight change and risk of adverse pregnancy outcomes: a population-based study. Lancet, 2006, 368(9542):1164-70.

[159] Solomons, C, et al. A prospective study of Pregravid Determinants of GDM Journal of the American Medical Association 1997, 278(13):1078-1083.

[160] Johnson, S., et al. Maternal obesity and pregnancy. Surg Gynecol Obstet, 1987. 164:431-437.

[161] Stephansson, O, et al. Maternal weight, pregnancy weight gain and the risk of antepartum still birth. American Journal of Obstetrics and Gynecology, 2001, 184:463-9.

[162] Prentice A, Goldberg G. Maternal obesity increases congenital malformations. Nutrition Reviews. 1996;54:146-152

[163] Kallen, K., Maternal smoking, BMI and neural tube defects. American Journal of Epidemiology, 1998, 147(12):1103-11.

[164] Galtier-Dereure F et al. Obesity and pregnancy: complications and costs. American Journal of Clinical Nutrition 2000; 71 (suppl): 1242S-8S.

[165] Cnattingius S et al. Prepregnancy Weight and Risk of Adverse Pregnancy Outcomes. New England Journal of Medicine1998; 338: 147-52

[166] Rasmussen, K. and B. Adams. Annotation: cigarette smoking, nutrition and birthweight. American Journal of Public Health, 1997, 87:543-544.

[167] Olafsdottir, A, et al. Combined effects of maternal smoking status and dietary intake related to weight gain and birth size parameters. BJOG, 2006, 113(11):1296-302.

[168] Schieve, L, et al. Trend in Pregnancy weight gain within and outside ranges recommended by the IOM in a Women-Infants-Children Population. Maternal Child Health Journal, 1998, 2(2):111-116.

[169] Institute of Medicine. Committee on Nutritional Status During Pregnancy and Lactation. Nutrition During Pregnancy: Part I, Weight Gain: Part II, Nutrient Supplements. 1990, National Academy Press: Washington, DC.

[170] Wolff, S. PhD thesis Impact of Dietary Factors and Calorie Restriction on Excessive Gestational Weight Gain in Obese Women. The Royal Veterinary and Agriculture University, Denmark 2005.

[171] Department of Health, DRVs for Food and Nutrients for the UK. 1991, HMSO: London.

[172] Feig, D. and C. Naylor, Eating for two: are guidelines for weight gain during pregnancy too liberal? Lancet 1998, 351:1054-55.

[173] Committee on the Impact of Pregnancy Weight on Maternal and Child Health, National Research Council. Influence of Pregnancy Weight on Maternal and Child Health: Workshop Report 2007 ISBN-10: 0-309-10406. The National Academies. 2007.

[174] Shils, M et al. Modern Nutrition in Health and Disease. 1994, Philadelphia: Lea Febiger.

[175] Linné, Y. and S. Rössner, Interrelationships between weight development and weight retention in subsequent pregnancies: the SPAWN study. Acta Obstetricia et Gynecologica Scandinavica, 2003, 82:318-325.

[176] Cheung, W. The Relationship Between Weight Gain in Pregnancy, Birth-Weight and Postpartum Weight Retention. Australia and New Zealand Journal of Obstetrics and Gynaecology 1998, 38(2):176-9.

[177] Harris, H et al. Do the psychosocial and behavioural changes that accompany motherhood influence the impact of pregnancy and long term weight gain? . J Psychosom. Obstet Gynaecol, 1999, 20(2): 65-79.

[178] Keppel, K. and S. Taffel, Pregnancy-related weight gain and retention: implications of the 1990 Institute of Medicine guidelines. American Journal of Public Health 1993, 83: 1100-1103.

[179] Smith, D., et al. Longitudinal changes in adiposity associated with pregnancy. The CARDIA Study. Coronary Artery Risk Development in Young Adults Study. Journal of the American Medical Association 1994, 271:1747-1751.

[180] Walker, L., et al. Do low-income women attain their pre-pregnant weight by the 6th week of postpartum? Ethnicity and Disease, 2004, 14: 119-126.

[181] Billewicz, W., Body weight in parous women. British Journal of Preventive and Social Medicine, 1970. 24(2):97-104.

[182] Wolfe, W., et al. Parity-Associated Weight Gain and its Modification by Sociodemorgraphic and Behavioural Factors: A Prospective Analysis in US Women. International Journal of Obesity and Related Metabolic Disorders, 1997, 21(9):802-10.

[183] Williamson, D., et al. A Prospective study of Childbearing and 10 year weight gain in US White women 25-45 Years of Age. International Journal of Obesity and Related Metabolic Disorders, 1994, 18(8):561-69.

[184] Gunderson, E. and Abrams, V. Epidemiology of Gestational Weight Gain and Body Weight Changes after Pregnancy. Epidemiologic Reviews, 1999, 21:261-75.

[185] Linné, Y. and S. Rössner, Interrelationships between weight development and weight retention in subsequent pregnancies: the SPAWN study. Acta Obstetricia et Gynecologica Scandinavica, 2003, 82:318-325.

[186] Winkvist, A. and K. Rasmussen. Impact of Lactation on Maternal Body Weight and Body Composition. Journal of Mammary Gland Biology and Neoplasia, 1999, 4(3):309-18.

[187] Mckeown, T. and R. Record, The influence of Reproduction on Body Weigth in Women. Journal of Endocrinology, 1957. 15: 393-409.

[188] Hilson, J. et al. Excessive Weight Gain during Pregnancy Is Associated with Earlier Termination of Breast-Feeding among white Women. J Nutr, 2006, 136(1): 140-146.

[189] Rasmussen, K. and C. Kjolhede, Prepregnant overweight and obesity diminish the prolactin response to suckling in the first week postpartum. Pediatrics, 2004, 113(5): 465-471.

[190] Office of the Chief Statistician Scottish Index of Multiple Deprivation 2004 Summary technical report, Scottish Office, Edinburgh, 2004, modified April 2006. http://www.scotland.gov.uk/Resource/Doc/47251/0027011.pdf, accessed 6 May 2007.

[191] Feig, D. and C. Naylor, Eating for two: are guidelines for weight gain during pregnancy too liberal? Lancet, 1998, 351: 1054-55.

[192] Olafsdottir, A., et al. Combined effects of maternal smoking status and dietary intake related to weight gain and birth size parameters. BJOG, 2006, 113(11): 1296-302.

[193] Robertson, A., et al. Food and health in Europe: a new basis for action. 2004, Copenhagen: World Health Organization Regional Office for Europe.

[194] IOM Nutrition during Lactation Summary, Conclusions and Recommendations 1991, National Academy Press Washington D.C.

[195] Erkkola, M., et al. Folate, vitamin D, and iron intakes are low among pregnant Finnish women. Eur J Clin Nutr, 1998, 52(10): 742-8.

[196] Derbyshire E., Davies J., Costarelli V., Dettmar P. Prepregnancy body mass index and dietary intake in the first trimester of pregnancy. J Hum Nutr Dietet 2006; 19: 267-273.

[197] Mathews, F et al. Folates in the periconceptional period: are women getting enough? Br J Obstet Gynaecol, 1998, 105(9): 954-9.

[198] Bray, G. and B. Popkin, Dietary Intake Does Affect Obesity. American Journal of Clinical Nutrition, 1998, 68(6): 1157-73.

[199] Shelton, N.J., What not to eat: inequalities in healthy eating behaviour, evidence from the 1998 Scottish Health Survey. J Public Health, 2005, 27(1): 36–44.

[200] Delisle, H., Programming of chronic disease by impaired fetal nutrition. Evidence and implications for policy and intervention strategies. 2002, World Health Organization Regional Office for Europe: Copenhagen.

[201] American Academy of Pediatrics (AAP)/American College of Obstetricians and Gynecologist (ACOG) Guidelines for Perinatal Care. 4th ed. . 1997, Elk Grove Village, IL: American Academy of Pediatrics.

[202] Sternfield, B., Physical Activity and Pregnancy Outcome. Review and Recommendations. Sports Medicine, 1997, 23: 33-47.

[203] Clapp JF 3rd. Exercise during pregnancy. A clinical update. Clin Sports Med 2000;19(2):273-286.

[204] McCrory, M., The Role of Diet and Exercise in Postpartum Weight Management. Journal of Nutrition Today, 2000, 35(5).

[205] Schmidt, M., et al. Physical activity patterns during pregnancy in a diverse Population of Women. Journal of Women´s Health, 2006, 15: 909-918.

[206] Bulik CM et al. Patterns of remission, continuation and incidence of broadly defined eating disorders during early pregnancy in the Norwegian Mother and Child Cohort Study (MoBa). Psychol Med. 2007; 10:1-10.

[207] Pomerleau, J. et al. Socioeconomic inequalities in obesity in Europe: issues and policy implications. Discussion paper for a WHO Regional Office for Europe Consultation on Inequalities and Obesity, London 13-14 December 2005. 2005.

[208] Sobal, J. and A.J. Stunkard, Socioeconomic status and obesity: A review of the literature. Psychological Bull, 1989. 105(2): 260-275.

[209] Walsh JM. Murphy DJ Weight and Pregnancy. BMJ 2007; 335: 169.

[210] Martin R et al Breastfeeding in infancy and social mobility: 60 year follow-up of Boyd Orr Chorhort. Arch Dis. Child 2007, doi:10.1130/adc.2006.105494

[211] IOM Nutrition during pregnancy: report of the Committee on Nutritional Status During Pregnancy and Lactation. 1990, National Academy Press: Washington, D.C.

[212] Kensara, O., et al. Fetal programming of body composition: relation between birth weight and body composition measured with dual-energy X-ray absorptiometry and anthropometric methods in older Englishmen. American Journal of Clinical Nutrition, 2005, 82(5): 980-7.

[213] Barker, D., The developmental origins of adult disease. Journal of the American College of Nutrition, 2004, 23(6 Suppl): 588S-595S.

[214] Langley-Evans, S., Developmental programming of health and disease. Proceedings of the Nutrition Society, 2006, 65: 97-105.

[215] World Health Organization Regional Office for Europe, The European health report 2005. Public health action for healthier children and populations. 2005, World Health Organization Regional Office for Europe: Copenhagen.

[216] Robertson, A., et al. Food and Health in Europe: A new basis for action. WHO Regional Publications, European Series, No. 96. 2004.

[217] Curhan G.C., et al. Birth weight and aduilt hypertension and obesity in women. Circulation 1996; 94:1310-15.

[218] Baeten, J et al. Pregnancy complications and outcomes among overweight and obese nulliparous women. American Journal of Public Health, 2001, 91(3): 436-40.

[219] Schieve, L et al. Trend in Pregnancy weight gain within and outside Ranges recommended byt the IOM in a Women-Infants-Children Population. Maternal Child Health Journal, 1998, 2(2): 111-116.

[220] Schack-Nielsen, L., et al. Secular Change is Size at Birth from 1973 to 2003: National Data from Denmark. Obesity (Silver Springs), 2006, 14(7): 1257-1263.

[221] An Action Plan for Improving oral health and modernising NHS dental services in Scotland 2005 Scottish Executive, Edinburgh.

[222] Davies GN. Early Childhood Caries: A Synopsis. Community Dent. Oral Epidemiol. 1998; 26 (1 Suppl): 106-116.

[223] Bogen, DL et al. The effect of breast-feeding with and without formula use on the risk of obesity at 4 Years of Age. Obesity Research, 2004, 12(9): 1527-1535.

[224] Toschke, A., et al. Overweight and obesity in 6- to 14-year-old Czech children in 1991: protective effect of breast-feeding. J Pediatr. 2002 Dec;141(6):764-9

[225] Liese, A., et al. Inverse association of overweight and breast feeding in 9 to 10-y-old children in Germany. International Journal of Obesity and Related Metabolic Disorders, 2001, 25(11): 1644-50.

[226] Frye, C. and J. Heinrich, Trends and predictors of overweight and obesity in East German children. International Journal of Obesity 2003, 27: 963-969.

[227] Kvaavik, E et al. Surveys of Norwegian youth indicated that breast feeding reduced subsequent risk of obesity. Journal of Clinical Epidemiology 2005, 58(8): 849-55.

[228] Scholtens, S., et al. Breastfeeding, Weight Gain in Infancy, and Overweight at Seven Years of Age: The Prevention and Incidence of Asthma and Mite Allergy Birth Cohort Study American Journal of Epidemiology, 2007.

[229] Owen, C., et al. The effect of breastfeeding on mean body mass index throughout life: a quantitative review of published and unpublished observational evidence. American Journal of Clinical Nutrition, 2005, 82(6): 1298-307.

[230] Arenz S, et al. Breast-feeding and childhood obesity--a systematic review. International Journal of Obesity and Related Metabolic Disorders. 2004;28:1247-56.

[231] Harder, T., et al. Duration of breastfeeding and risk of overweight: a meta-analysis. American Journal of Epidemiology, 2005, 162(5): 397-403.

[232] de Onis, M et al. WHO Multicentre Growth Reference Study (MGRS): Rationale, planning, and implementation. Food and Nutrition Bulletin 2004;25(supplement 1):S3-S84.

[233] Koletzko, B., et al. Protein intake in the first year of life: a risk factor for later obesity? The E.U. childhood obesity project. Adv Exp Med Biol, 2005, 569: 69-79.

[234] Norris FJ et al. Factors affecting the introduction of complementary food in the preterm infant. European Journal of Clinical Nutrition 2002; 56:448-54.

[235] Bergmann, K., et al. Early determinants of childhood overweight and adiposity in a birth cohort study: role of breast-feeding. International Journal of Obesity and Related Metabolic Disorders, 2003, 27(2): 162-72.

[236] Shuka A et al. Infantile overnutrition in the first year of life: a field study in Dudley Worcester. British Medical Journal 1972; 4:507-15

[237] Davies DP et al. Effects of solid foods on growth of bottle fed infants in first three months of life. British Medical Journal 1977; 2:7-8

[238] Baker J, et al. Maternal prepregnant body mass index, duration of breastfeeding, and timing of complementary food introduction are associated with infant weight gain. American Journal of Clinical Nutrition. 2004;80(6):1579-88

[239] Waterland, R. and R. Jirtle, Transposable elements: targets for early nutritional effects on epigenetic gene regulation. Molecular and Cell Biology, 2003, 23(15): 5293-300.

[240] Stunkard, A., et al. Energy intake, not energy output, is a determinant of body size in infants. American Journal of Clinical Nutrition, 1999, 69(3): 524-30.

[241] Leathwood, P. and A. Maier, Early influences on taste preferences, in Feeding during late infancy and early childhood: Impact on Health. Nestlé Nutr Workshop Ser Pediatr Program vol. 56: 127-141, O. Hernell and J. Schmitz, Editors.

[242] Infant and Young Child Feeding: Standard Recommendations for the European Union 2006 http://ilca.org/liasion/Infant-and-YoungChildFeeding/EUPolicy06English.pdf accessed on 7 October 2007.

[243] Armstrong J et al. Coexistence of social inequalities in undernutrition and obesity in preschool children: population cross sectional study. Arch Dis Child, 2003, 88: 671-675

[244] Nelson M. Childhood nutrition and poverty. Proceedings of the Nutrition Society, 2000, 59, 307-315.

[245] Parsons, T.J., et al. Childhood predictors of adult obesity: a systematic review. International Journal of Obesity and Related Metabolic Disorders, 1999, 23 Suppl 8: S1-107.

[246] Mathieson, A. and T. Koller, Addressing the socioeconomic determinants of healthy eating habits and physical activity levels among adolescents. WHO/HBSC FORUM 2006. Copenhagen, World Health Organization, 2006. (http://www.euro.who.int/Document/e89375.pdf, accessed February 2007).

[247] Hayden-Wade, H.A., et al. Prevalence, characteristics, and correlates of teasing experiences among overweight children vs. non-overweight peers. Obesity Research, 2005, 13(8): 1381-1392.

[248] Batty GD et al. Childhood IQ in relation to risk factors for premature mortality in middle-aged persons: the Aberdeen Children of the 1950s study. Journal of Epidemiology and Community Health 2007; 61: 241-247

[249] Lin, B. et al. Factors associated with women's and children's body mass indices by income status. International Journal of Obesity and Related Metabolic Disorders, 2004, 28(4): 536-42.

[250] Haveman, R. and T. Smeeding, The role of higher education in social mobility. Future Child, 2006, 16(2): 125-50.

[251] Viner, R.M. and T.J. Cole, Adult socioeconomic, educational, social, and psychological outcomes of childhood obesity: a national birth cohort study. Bmj, 2005, 330(7504): 1354.

[252] Datar, A et al. Childhood overweight and academic performance: national study of kindergartners and first-graders. Obesity Research, 2004, 12(1): 58-68.

[253] Laitinen, J., et al. Unemployment and obesity among young adults in a northern Finland 1966 birth cohort. International Journal of Obesity and Related Metabolic Disorders, 2002, 26(10): 1329-38.

[254] Mikkila, V., et al. Associates of obesity and weight dissatisfaction among Finnish adolescents. Public Health Nutrition, 2003, 6(1): 49-56.

[255] Sargent, J.D. and D.G. Blanchflower, Obesity and stature in adolescence and earnings in young adulthood. Analysis of a British birth cohort. Arch Pediatr Adolesc Med, 1994, 148(7): 681-687.

[256] Sigfusdottir, I., A. Kristjansson, and J. Allegrante, Health behaviour and academic achievement in Icelandic school children. Health Educ Res, 2007, 22(1): 70-80.

[257] Taras, H. and W. Potts-Datema, Obesity and student performance at school. J Sch Health, 2005, 75(8): 291-295.

[258] Sigfusdottir, I., A. Kristjansson, and J. Allegrante, Health behaviour and academic achievement in Icelandic school children. Health Educ Res, 2007, 22(1): 70-80.

[259] Mathieson, A. and T. Koller, Addressing the socioeconomic determinants of healthy eating habits and physical activity levels among adolescents. WHO/HBSC FORUM 2006. Copenhagen, World Health Organization, 2006. (http://www.euro.who.int/Document/e89375.pdf, accessed February 2007).

[260] Lake, J. et al. Child to adult body mass index in the 1958 British birth cohort: Associations with parental obesity. Arch Dis Child, 1997, 77: 376-381.

[261] Guo, S., et al. Body mass index during childhood, adolescence and young adulthood in relation to adult overweight and adiposity: the Fels Longitudinal Study. International Journal of Obesity and Related Metabolic Disorders, 2000, 24: 1628-35.

[262] Kaplowitz, H., et al. Serial and parent-child changes in components of body fat distribution and fatness in children from the London Longitudinal Growth Study, ages two to eighteen years. Hum Biol 1988. 60: 739-758.

[263] Jackson, A. and S. Wootton, Effects of Early Nutrition on Later Development of Obesity. Scientific contribution to Ministerial Conference on Counteracting Obesity. Commissioned by the WHO Regional Office for Europe. 2006, Institute of Human Nutrition, University of Southampton: Southampton.

[264] Whittaker, R., et al. Predicting obesity in young adulthood from childhood and parental obesity. New England Journal of Medicine, 1997, 337: 869-73.

[265] Rolland-Cachera, M., et al. Early adiposity rebound: causes and consequences for obesity in children and adults. International Journal of Obesity (London), 2006, 30(Suppl 4): S11-7.

[266] Eriksson, J., et al. Early adiposity rebound in childhood and risk of type 2 diabetes in adult life. Diabetologia, 2003, 46: 190-194

[267] Rolland-Cachera, M., et al. Adiposity rebound in children: a simple indicator for predicting obesity. American Journal of Clinical Nutrition, 1984. 39(1): 129-35.

[268] Must, A., et al. Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. New England Journal of Medicine, 1992. 327(19): 1350-5.

[269] Dietz, W., Critical periods in childhood for the development of obesity. American Journal of Clinical Nutrition, 1994, 59: 955-959.

[270] Srinivasan, S., et al. Adolescent overweight is associated with adult overweight and related multiple cardiovascular risk factors: the Bogalusa Heart Study. Metabolism, 1996, 45(2): 235-40.

[271] Lobstein, T. and R. Leach, Diabetes may be undetected in many children in the UK. British Medical Journal, 2004, 328(7450): 1261-c-1262.

[272] Scott, C., et al. Characteristics of youth-onset noninsulin-dependent diabetes mellitus and insulin-dependent diabetes mellitus at diagnosis. Pediatrics, 1997, 100(1): 84-91.

[273] Obesity in childhood. Report of an expert committee convened by the World Health Organization, Kobe, June 2005 (rapporteurs' draft). 2007 (in press), World Health Organization: Geneva.

[274] Forbes, G., Human Body Composition. Growth, Aging, Nutrition, and Activity. 1987, New York: Springer-Verlag.

[275] Sheiham A, Dietary Effects on Dental Diseases. Public Health Nutrition, 2001, 4(2B), 569-591.

[276] Marthaler, T.M., et al. The Prevalence of Dental Caries in Europe 1990-1995. Caries Research, 1996, 30: 237-55.

[277] Gregory J et al. National Diet and Nutrition Survey: Young People Aged 4 to 18 Years. Vol. 1: Report of the Diet and Nutrition Survey. The Stationery Office: London, 2000

[278] Benton D. Micronutrient supplementation and intelligence of children. Neuroscience and Biobehavioural Reviews 2001, 25.4:297-309

[279] Richardson AJ & Montgomery P. The Oxford Durham Study: a randomised controlled trial of fatty acid supplementation in children with developmental coordination disorder. Pediatrics 2005 115: 1360-66

[280] Rolls, B et al. Serving portion size influences 5-year-old but not 3-year-old children's food intakes. J Amer Diet Assoc, 2000, 100: 232-234.

[281] McConahy, K., et al. Food portions are positively related to energy intake and body weight in early childhood. J Pediatr, 2002, 140: 340-347.

[282] Cullen KW et al. Intake of soft drinks, fruit-flavored beverages, and fruits and vegetables by children in grades 4 through 6. American Journal of Public Health, 2002, 92(9):1475-8

[283] Nelson, M., Childhood nutrition and poverty. Proceedings of the Nutrition Society, 2000, 59(2): 307-15.

[284] Hoglund, D., G. Samuelson, and A. Mark, Food habits in Swedish adolescents in relation to socioeconomic conditions. Eur J Clin Nutr, 1998, 52(11): 784-9.

[285] Mathieson, A. and T. Koller, Addressing the socioeconomic determinants of healthy eating habits and physical activity levels among adolescents. WHO/HBSC FORUM 2006. Copenhagen, World Health Organization, 2006. (http://www.euro.who.int/Document/e89375.pdf, accessed February 2007).

[286] Elgar, F., et al. Sedentary behaviour, physical activity and weight problems in adolescents in Wales. Public Health, 2005, 119(6): 518–524.

[287] Wareham, NJ et al. Physical activity and obesity prevention: a review of the current evidence. Proceedings of the Nutrition Society, 2005, 64(2): 229-247.

[288] Trost, S., et al. Physical activity in overweight and nonoverweight preschool children. International Journal of Obesity and Related Metabolic Disorders, 2003, 27(7): 834-9.

[289] Coggins, A., D. Swanton, and H. Crombie, Physical activity and inequalities. A briefing paper. 1999, Health Education Authority: London.

[290] Wardle, J. and A. Steptoe, Socioeconomic differences in attitudes and beliefs about healthy lifestyles. Journal of Epidemiology and Community Health, 2003, 57(6): 440-3.

[291] Dowler, E., Inequalities in diet and physical activity in Europe. Public Health Nutrition, 2001, 4(2B): 701-709.

[292] Tomorrow's Young Adults: 9-15 year-olds Look at Alcohol, Drugs, Exercise and Smoking. 1991, Health Education Authority: London.

[293] Muller, M., et al. Physical activity and diet in 5 to 7 years old children. Public Health Nutrition, 1999, 2(3a): 443-4.

[294] La Torre, G., et al. Extra-curricular physical activity and socioeconomic status in Italian adolescents. BMC Public Health, 2006, 6: 22.

[295] Inchley, J., et al. Persistent socio-demographic differences in physical activity among Scottish schoolchildren 1990-2002. Eur J Public Health, 2005, 15(4): 386-8.

[296] Thomas, N., et al. Physical activity and diet relative to socio-economic status and gender in British young people. Health Education Journal, 2006, 65(3): 223-235.

[297] Vereecken, C., et al. Television viewing behaviour and associations with food habits in different countries. Public Health Nutrition, 2006, 9(2): 244-50.

[298] Ibid.

[299] Shannon, B et al. Body fatness, television viewing and calorie intake in a sample of Pennsylvania sixth grade children. J Nutr, 1991. 23: 262-268.

[300] Yannakoulia, M., et al. Nutrition-related habits of Greek adolescents. European Journal of Clinical Nutrition, 2004, 58(4): 580-6.

[301]Mathieson, A. and T. Koller, Addressing the socioeconomic determinants of healthy eating habits and physical activity levels among adolescents. WHO/HBSC FORUM 2006. Copenhagen, World Health Organization, 2006. (http://www.euro.who.int/Document/e89375.pdf, accessed February 2007).

[302] Latner, J.D. and A.J. Stunkard, Getting worse: the stigmatization of obese children. Obesity Research, 2003, 11(3): 452-456.

[303] Mathieson, A. and T. Koller, Addressing the socioeconomic determinants of healthy eating habits and physical activity levels among adolescents. WHO/HBSC FORUM 2006. Copenhagen, World Health Organization, 2006. (http://www.euro.who.int/Document/e89375.pdf, accessed February 2007).

[304] Anderson, A., Nutrition interventions in women in low-income groups in the UK. Proc Nut Soc, 2007, 66:25-32.

[305] Erem, C., et al. Prevalence of obesity and associated risk factors in a Turkish population (trabzon city, Turkey). Obesity Research, 2004, 12(7): 1117-27.

[306] Obesity: Preventing and managing the global epidemic. Report of a WHO consultation on obesity. WHO Technical Report Series, 894. 2000

[307] Trichopoulou, A., A. Naska, and T. Costacou, Disparities in food habits across Europe. Proceedings of the Nutrition Society, 2002, 61(4): 553-558

[308] Roos, E., et al. Modern and healthy?: socioeconomic differences in the quality of diet. Eur J Clin Nutr, 1996, 50(11): 753-760.

[309] Irala-Estevez, J., et al. A systematic review of socio-economic differences in food habits in Europe: consumption of fruit and vegetables. Eur J Clin Nutr, 2000, 54(9): 706-714.

[310] Lopez-Azpiazu, I., et al. Disparities in food habits in Europe: systematic review of educational and occupational differences in the intake of fat. J Hum Nutr Diet, 2003, 16(5): 349-64.

[311] Friel, S., et al. Social diversity of Irish adults nutritional intake. Eur J Clin Nutr, 2003, 57(7): 865-75.

[312] Hulshof, K.F., et al. Socio-economic status, dietary intake and 10 y trends: the Dutch National Food Consumption Survey. Eur J Clin Nutr, 2003, 57(1): 128-137

[313] Molarius A. The contribution of lifestyle factors to socio-economic differences in obesity in men and women: a population-based study in Sweden. European Journal of Epidemiology, 2003, 18:227–234.

[314] Laurier, D., et al. Prevalence of obesity: a comparative survey in France, the United Kingdom and the United States. International Journal of Obesity 1992. 16: 565-572.

[315] Hellerstedt, W et al, The association between alcohol intake and adiposity in the general population. American Journal of Epidemiology, 1990. 132: 594-611.

[316] Erem, C., et al. Prevalence of obesity and associated risk factors in a Turkish population (trabzon city, Turkey). Obesity Research, 2004, 12(7): 1117-27.

[317] Molarius A. The contribution of lifestyle factors to socio-economic differences in obesity in men and women: a population-based study in Sweden. European Journal of Epidemiology, 2003, 18:227–234.

[318] Guthrie, J.F., B.H. Lin, and E. Frazao, Role of food prepared away from home in the American diet, 1977-78 versus 1994-96: changes and consequences. Journal of Nutrition Education and Behavior, 2002, 34(3): 140-150.

[319] Dowler, E., Inequalities in diet and physical activity in Europe. Public Health Nutrition, 2001, 4(2B): 701-709.

[320] Monteiro, C.A., et al. Socioeconomic status and obesity in adult populations of developing countries: a review. Bull World Health Organ, 2004, 82(12): 940-946.

[321] Estabrooks, P.A et al. Resources for physical activity participation: does availability and accessibility differ by neighborhood socioeconomic status? Annals of Behavioral Medicine, 2003, 25(2): 100-4.

[322] Sobal, J. and A.J. Stunkard, Socioeconomic status and obesity: A review of the literature. Psychological Bull, 1989. 105(2): 260-275.

[323] Kafatos, A., et al. Regional, demographic and national influences on attitudes and beliefs with regard to physical activity, body weight and health in a nationally representative sample in the European Union. Public Health Nutrition, 1999, 2(1a): 87–95.

[324] Wardle, J. and A. Steptoe, Socioeconomic differences in attitudes and beliefs about healthy lifestyles. Journal of Epidemiology and Community Health, 2003, 57(6): 440-3.

[325] Stahl, T., et al. The importance of policy orientation and environment on physical activity participation--a comparative analysis between Eastern Germany, Western Germany and Finland. Health Promot International, 2002, 17(3): 235-46.

[326] Glass, T et al. Neighborhoods and obesity in older adults: the Baltimore memory study. American Journal of Preventive Medicine, 2006, 31(6): 455-63.

[327] Cubbin, C., et al. Neighborhood deprivation and cardiovascular disease risk factors: protective and harmful effects. Scand J Public Health, 2006, 34(3): 228-37.

[328] Dowler, E., Inequalities in diet and physical activity in Europe. Public Health Nutrition, 2001, 4(2B): 701-709.

[329] Coggins, A. et al. Physical activity and inequalities. A briefing paper. 1999, Health Education Authority: London.

[330] Erem, C., et al. Prevalence of obesity and associated risk factors in a Turkish population (trabzon city, Turkey). Obesity Research 2004, 12(7): 1117-27.

[331] Puhl, R and Brownell, KD. Bias, discrimination, and obesity. Obesity Research 2001, 9(12): 788-805.

[332] Klesges, R.C., et al. The effects of applicant's health status and qualifications on simulated hiring decisions. International Journal of Obesity 1990. 14(6): 527-535.

[333] d'Hombres, B. and G. Brunello, Does obesity hurt your wages more in Dublin than in Madrid? Evidence from ECHP. IZA Discussion Paper No. 1704. 2005, Forschungsinstitut zur Zukunft der Arbeit / Institute for the Study of Labor: Bonn. (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=779084, accessed 7 January 2007).

[334] Cawley, J., Body weight and women's labor market outcomes, Working Paper No 7481, NBER. 2000.

[335] Pagán, J. and A. Dávilla, Obesity, occupational attainment, and earnings. Social Science Quarterly 1997, 78(3): 756–770.

[336] Chen, E.Y. and M. Brown, Obesity stigma in sexual relationships. Obesity Research, 2005, 13(8): 1393-1397.

[337] Freedman, V et al. Recent trends in disability and functioning among older adults in the United States: A systematic review. Journal of the American Medical Association 2002, 288:3137–46.

[338] Nelson, M., et al. The effects of multidimensional home-based exercise on functional performance in elderly people. J Gerontol A Biol Sci Med Sci, 2004, 59(2):154-60.

[339] Robertson A. et al Food and health in Europe: a new basis for action. Copenhagen: World Health Organization; 2004 p. 253.

[340] Ostchega, Y., et al. The prevalence of functional limitations and disability in older persons in the US: data from the National Health and Nutrition Examination Survey III. J Am Geriatr Soc, 2000, 48(9): 1132-5.

[341] Angleman, S et al. The role of waist circumference in predicting disability in periretirement age adults. International Journal of Obesity 2004, 30:364–373.

[342] Seidell, J. and T. Visscher. Body weight and weight change and their health implications for the elderly. European Journal of Clinical Nutrition, 2000, 54(Suppl 3):S33-S39.

[343] Launer, L., et al. Body mass index, weight change, and risk of mobility disability in middle-aged and older women. The epidemiologic follow-up study of NHANES I. Journal of the American Medical Association 1994, 271:1093-1098.

[344] Seidell, J. and T. Visscher, Body weight and weight change and their health implications for the elderly. European Journal of Clinical Nutrition, 2000, 54(Suppl 3):S33-S39.

[345] Ostman, J et al. Catecholamines and metabolism of human adipose tissue. I. Comparison between in vitro effects of noradrenaline, adrenaline and theophylline on lipolysis in omental adipose tissue. Acta Med Scand 1969. 186:241-246.

[346] Seidell, J., et al. Visceral fat accumulation in men is positively associated with insulin, glucose, and C-peptide levels, but negatively with testosterone levels. Metabolism 1990. 39:897-901.

[347] Seidell, J. and T. Visscher, Body weight and weight change and their health implications for the elderly. European Journal of Clinical Nutrition 2000, 54(Suppl 3):S33-S39.

[348] Visscher, T., et al. A comparison of body mass index, waist – hip ratio and waist circumference as predictors of all-cause mortality among the elderly: the Rotterdam study. International Journal of Obesity 2001, 25:1730–1735.

[349] Despres, J. Metabolic dysfunction and exercise, in Exercise and Obesity, A. Hills and W. ML, Editors. 1994, Smith-Gordon: London.

[350] Lehmann, A. and E. Bassey, Longitudinal weight changes over four years and associated health factors in 629 men and women aged over 65. Eur J Clin Nutr, 1996, 50:6-11.

[351] Turcato, E., et al. Waist circumference and abdominal sagittal diameter as surrogates of body fat distribution in the elderly: Their relation with cardiovascular risk factors. International Journal of Obesity 2000, 24:1005–10.

[352] Seidell, J. and T. Visscher, Body weight and weight change and their health implications for the elderly. European Journal of Clinical Nutrition, 2000, 54(Suppl 3):S33-S39.

[353] Benetos, A., et al. Aldosterone and Telomere Length in White Blood Cells. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 2005, 60:1593-1596.

[354] Cherkas, L., et al. The effects of social status on biological aging as measured by white-blood-cell telomere length. Aging cell, 2006, 5(5):361.

[355] Sheiham A. Dietary Effects on Dental Diseases. Public Health Nutrition, 2001, 4(2B), 569-591.

[356] Hung, H.-C., et al. Tooth loss and dietary intake. J Am Dent Assoc, 2003, 134:1185–1192.

[357] de Oliveira, T. and M. Frigerio, Association between nutrition and the prosthetic condition in edentulous elderly. Gerodontology, 2004, 21:205–208.

[358] Liedberg, B., et al. 'Inadequate' dietary habits and mastication in elderly men. Gerodontology, 2007, 24:41-46.

[359] de Castro, J., Socio-cultural determinants of meal size and frequency. Br J Nutr, 1997, 77:39S-54S.

[360] Krebs-Smith, S., Smiciklas-Wright, and J. Krebs-Smith, The effect of variety in food choices on dietary quality. Journal of the American Dietetics Association 1987. 87:897-903.

[361] Trichopoulou, A., et al. Diet and overall survival in elderly people. British Medical Journal 1995, 311:1457-1460.

[362] Turrell, G., et al. A multilevel analysis of socioeconomic (small area) differences in household food purchasing behaviour. Journal of Epidemiology and Community Health, 2004, 58:208–15.

[363] Kelly, F. and A. Parker, A Study of Retail Accessibility for Older People. The Elderly Poor and their Access to Grocery and Financial Services in Dublin. 2005, The Centre for Retail Studies, National University of Ireland: Dublin.

[364] Fries, J., Physical activity, the compression of morbidity, and the health of the elderly. J R Soc. Med, 1996, 89:64-68.

[365] Ho, S., et al. Predictors of mobility decline: the Hong Kong Old-Old Study. Journal of Gerontology 1997, 25:M356-M362.

[366] Wolfson, L., et al. Balance and strength training in older adults: intervention gains and Tai Chi maintenance. Journal of the American Geriatric Society, 1996, 44:498 ± 506.

[367] Dipietro, L., et al. Moderate-intensity aerobic training improves glucose tolerance in aging independent of abdominal adiposity. Journal of the American Geriatric Society, 1998, 46:875-879.

[368] Woo, J., Relationships among diet, physical activity and other lifestyle factors and debilitating diseases in the elderly. European Journal of Clinical Nutrition, 2000, 54(Suppl 3):S143-S147.

[369] Visser, M., et al. High body fatness, but not low-free mass, predicts disability in older men and women: the Cardiovascular Health Study. American Journal of Clinical Nutrition, 1988. 68(584-590).

[370] Kelly, F. and Parker, A. A Study of Retail Accessibility for Older People. The Elderly Poor and their Access to Grocery and Financial Services in Dublin. 2005, The Centre for Retail Studies, National University of Ireland: Dublin.

[371] Fogelholm, M., et al. Rural–urban differences in health and health behaviour: A baseline description of a community health-promotion programme for the elderly. Scandinavian Journal of Public Health, 2006, 34(6):632–640.

[372] Patterson, P. and Chapman, N. Urban form and older residents' service use, walking, driving, quality of life and neighborhood satisfaction. Am J Health Promotion, 2004, 19:45–52.

[373] Parks, S et al. Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States. Journal of Epidemiology and Community Health, 2003, 57(29–35).

[374] Wahlqvist, M. and Savige, G. Interventions aimed at dietary and lifestyle changes to promote healthy aging. European Journal of Clinical Nutrition, 2000, 54(Suppl 3):S148-S156.

[375] Stelmach, W, et al. The association between income, education, lifestyle and psychosocial stressor and obesity in elderly. Wiad Lek, 2005, 58(9-10):481-90.

[376] Robertson A. et al Food and health in Europe: a new basis for action. Copenhagen: World Health Organization; 2004 p.60-61.

[377] Københavns Kommune FoA. Evalueringsrapport for sundhedsprojektet, kontaktstedet Mændenes Hjem og Kontakstedet Forchhammersvej, Copenhagen Municipality, 2005.

[378] Cole-Hamilton, I., Lang, T. Tightening Belts: A Report of the Impact of Poverty on Food, LFC , London, London Food Commission Report 13, London 1986.,

[379] Conway, J. Prescription for Poor Health. The Crisis for Homeless Families, London Food Commission, Maternity Alliance, SHAC and Shelter, London 1988.

[380] Cole-Hamilton I and Lobstein T, Poverty and Nutrition. Survey, NCH Action for Children, London 1991.

[381] Dowler E, Calvert C. Nutrition and Diet in Lone Parent Families in London, York, Joseph Rowntree Foundation, 1994.

[382] Leather, S. The Making of Modern Malnutrition. London: The Caroline Walker Trust, 1996.

[383] Malmauret, L., et al. Dietary intakes and vitamin status in a homeless population: there is a will, but is there a way? J Gen Intern Med, 2002, 17(5):369-372.

[384] Forrester, J., Nutritional Alterations in Drug Abusers With and Without HIV. American Journal of Infectious Diseases, 2006, 2(3):173-179.

[385] Johnson, L. and A. McCool, Dietary intake and nutritional status of older adult homeless women: a pilot study. J Nutr Elder, 2003, 23(1):1-21.

[386] Sørensen, C. På den skæve klinge. Beretning fra et anderles cykelløb. 2006, Landsforeningen af VæreSteder: Fredericia.

[387] Simonsen, K., et al. Hvad ved vi om socialt udsattes sundhed? Gennemgang af litteratur samt analyseaf eksisterende datamaterialer vedrørende socialt udsattes sundhedsvaner, helbred og sygelighed. Rådet for Socialt Udsatte, 2007 (http://www.si-folkesundhed.dk/Ugens%20tal%20for%20folkesundhed/Ugens%20tal/10_2007.aspx, accessed March 2007).

[388] Christensen, A et al. Sundhedsprofil for socialt udsatte baseret på SUSY-2007. 2007.

[389] Simonsen, K., et al. Hvad ved vi om socialt udsattes sundhed? Gennemgang af litteratur samt analyseaf eksisterende datamaterialer vedrørende socialt udsattes sundhedsvaner, helbred og sygelighed Rådet for Socialt Udsatte 2007 (http://www.si-folkesundhed.dk/Ugens%20tal%20for%20folkesundhed/Ugens%20tal/10_2007.aspx, accessed March 2007). 2007.

[390] Lee, T, et al. Risk Factors for cardiovascular disease in homeless adults Circulation 2005, 111(20):2629-2635.

[391] Bhopal, R., What is the risk of coronary heart disease in South Asians? A review of UK research. Journal of Public Health Medicine, 2000, 22(3):375-85.

[392] Dhawn, J., et al. Insulin resistance, high prevalence of diabetes, and cardiovascular risk in immigrant Asians. British Heart Journal 1994, 72:413-21.

[393] Carballo, M et al. Migration and health in the European Union. Tropical Medicine & International Health 1998, 3(12):936.

[394] Sharma, A et al. The availability of advice regarding infant feeding to immigrants of Vietnamese origin: a survey of families and health visitors. Child Care and Healthy Development 1994, 20(5): 349-54.

[395] Sundquist, J et al. Body mass index and distribution of body fat in female Bosnian refugees--a study in primary health care. Public Health 1999, 113(2): 89-93.

[396] Daryani, A., Diet and Metabolic Risk Factors in Immigrant Women from the Middle East and Swedish-Born Women. A Cross-Sectional Study of Women from Iran, Turkey and Sweden (www.diva-portal.org/diva/getDocument?urn_nbn_se_uu_diva-7103-1__fulltext.pdf, accessed March 2007), in Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Social Sciences 15. 2006, University of Uppsala: Uppsala, Sweden.

[397] WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet, 2004 363(9403):157-63.

[398] Kagawa M et al. Is the BMI cut-off level for Japanese females for obesity set too high? A consideration from a body composition perspective. Asia Pacific Journal of Clinical Nutrition, 2006 15(4):502-7.

[399] Powell AD, Kahn AS. Racial differences in women's desires to be thin. International Journal of Eating Disorders 1995 17(2):191-5.

[400] Hakeem R et al. Urbanisation and health related knowledge and attitudes of South Asian children. Journal of the Pakistani Medical Association. 2001 51(12):437-43.

[401] Sheiham A. Dietary Effects on Dental Diseases. Public Health Nutrition, 2001, 4(2B), 569-591.

[402] Stellinga-Boelen, A., P. Wiegersma, and C. Bijleveld, Dietary intake in asylum seeker children in The Netherlands, strongly related to age and origin. European Journal of Clinical Nutrition 2007, 61: 104–110.

[403] Brazdova, Z. et al. [Dietary habits of Romany children] (in Czech). Ceskoslovenska pediatrie, 1998, 53:419-423.

[404] Brazdova, Z et al. [Serving equivalents of food groups as a tool for evaluation of food consumption in Romany children] (in Czech). Hygiena, 1998, 43:195-206.

[405] Daryani, A., Diet and Metabolic Risk Factors in Immigrant Women from the Middle East and Swedish-Born Women. A Cross-Sectional Study of Women from Iran, Turkey and Sweden (www.diva-portal.org/diva/getDocument?urn_nbn_se_uu_diva-7103-1__fulltext.pdf, accessed March 2007), in Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Social Sciences 15. 2006, University of Uppsala: Uppsala, Sweden.

[406] Sundquist, J. et al. The influence of social and ethnic segmentation on consultation in primary health care. Scandinavian Journal of Social Welfare, 1994, 3:19-23.

[407] Ibid.

[408] Liebkind, K., Acculturation and stress: Vietnamese refugees in Finland. Journal of Cross-Cultural Psychology, 1996, 27:161-180.

[409] Bhopal, R., Ethnicity, race and health in multicultural societies. Foundations for better epidemiology, public health and health care. 2007, Oxford: Oxford University Press.

[410] Hardeman W et al. Interventions to prevent weight gain, a systematic review of psychological models and behaviour change methods. Int J Obes Relat Metab Disord, 2000, 24, 131-143.

[411] Stockley L. Consolidation and updating the evidence base for the promotion of breastfeeding. Cardiff: National Assembly for Wales, 2001. Available at www.wales.nhs.uk/publications/bfeedingevidencebase.pdf (accessed August 2007).

[412] Fairbank L, O'Meara S, Renfrew MJ, et al. A systematic review to evaluate the effectiveness of interventions to promote the initiation of breastfeeding. Health Technology Assessment Programme 2000;4(25):1-169. Available at http://www.hta.ac.uk/project/1084.asp (accessed August 2007).

[413] Sjostrom M, Sockley L. Toward Public Health Nutrition Strategies in the European Union to implement Food Based Dietary Guidelines and to enhance healthier lifestyles. Working Party 3: EURODIET Final report. Heraklion: University of Crete. 2000. See http://eurodiet.med.uoc.gr/ (accessed August 2007).

[414] Meininger JC. School-based interventions for primary prevention of cardiovascular disease: evidence of effects for minority populations. Annu Rev Nurs Res. 2000;18:219–244.

[415] Dobbins M et al. *The effectiveness of school-based interventions in promoting physical activity and fitness among children and youth, a systematic review. Final Report*. City of Hamilton, Effective Public Health Practice Project, 2001. (http://www.nhsru.com/documents/Physical-Activity-Review.pdf, accessed 20 December 2006.)

[416] Dietz W & Gortmaker S. Preventing obesity in children and adolescents. Annual Review of Public Health, 2001, 22:337-353

[417] Steinbeck K. The importance of physical activity in the prevention of overweight and obesity in childhood: a review and an opinion. Obes Rev, 2001, 2:117-130.

[418] Campbell K, Waters E, O'Meara S, et al. Interventions for preventing obesity in childhood: A systematic review. Obes Rev. 2001;2(3):149-157.

[419] de Oliveira MI, Camacho LA, Tedstone AE. Extending breastfeeding duration through primary care: a systematic review of prenatal and postnatal interventions. J Hum Lact. 2001;17(4):326-343.

[420] French S, Story M, Jeffery RW. Environmental influences on eating and physical activity. Annual Review of Public Health 2001;22:309-335.

[421] Lytle LA, Jacobs DR, Perry CL, et al. Achieving physiological change in school-based intervention trials: what makes a preventive intervention successful? Brit J Nutr 2002;88(3):219-221.

[422] Task Force on Community Preventive Services. Recommendations to increase physical activity in communities. Am J Prev Med. 2002;22(Suppl 4):67-72.

[423] Micucci S, Thomas H, Vohra J. The Effectiveness of School-Based Strategies for the Primary Prevention of Obesity and for Promoting Physical Activity and Nutrition, the Major Modifiable Risk Factors for Type 2 Diabetes: Review of Reviews. Hamilton: City of Hamilton Public Health Research, Education and Development Program, 2002.

[424] Swedish Council on Technology Assessment in Health Care. Obesity – problems and interventions. Report No., 160. Stockholm: The Swedish Council on Technology Assessment in Health Care, 2002. Available at http://www.sbu.se/Filer/Content0/publikationer/1/obesity_2002/obsesityslut.pdf (accessed August 2007).

[425] NHS Centre for Reviews and Dissemination (NHS-CRD) The prevention and treatment of childhood obesity. Effective Health Care Bulletin 2002;7(6):1-12. Available at http://www.york.ac.uk/inst/crd/ehc76.pdf (accessed August 2007).

[426] Kahn EB, Ramsey LT, Brownson RC, et al. The effectiveness of interventions to increase physical activity, a systematic review. Am J Prev Med. 2002;22(Suppl 4):73-107.

[427] Maziekas MT et al. Follow up exercise studies in paediatric obesity: implications for long term effectiveness. *Br J Sports Med,* 2003, 37:425-429.

[428] Swedish Council on Technology Assessment in Health Care. *Obesity – problems and interventions. A systematic review. Report No. 160*. Stockholm, The Swedish Council on Technology Assessment in Health Care, 2002. (http://www.sbu.se/Filer/Content0/publikationer/1/obesity_2002/obsesityslut.pdf, accessed 20 December 2006.)

[429] Reilly JJ, Wilson ML, Summerbell CD, et al. Obesity, diagnosis, prevention, and treatment, evidence based answers to common questions. Arch Dis Child 2002;86(6):392-394.

[430] Schmitz KH, Jeffrey RW. Prevention of obesity. In: Wadden TA, Stunkard AJ (eds) Handbook of Obesity Treatment. New York: Guilford Press, 2002, pp556-593.

[431] Kahn E, Ramsey L, Brownson R, Heath G, Howze E, Powell K, Stone EJ, Rajab MW, Corso P, Task Force on Community Preventive Services. The effectiveness of interventions to increase physical activity: a systematic review. Am J Prev Med 2002;22(Suppl4):73-106

[432] Muller MJ, Mast M, Asbeck I, et al. Prevention of obesity – is it possible? Obes Rev. 2003;2(1):15-28.

[433] Protheroe L et al. *The effectiveness of public health interventions to promote the initiation of breastfeeding: Evidence briefing*. London, Health Development Agency, 2003. (http://www.publichealth.nice.org.uk/download.aspx?o=502585, accessed 20 December 2006.)

[434] Reilly JJ & McDowell ZC. Physical activity interventions in the prevention and treatment of paediatric obesity: systematic review and critical appraisal. *Proc Nutr Soc*, 2003, 62:611-619.

[435] Mulvihill C, Quigley R. The management of obesity and overweight: an analysis of reviews of diet, physical activity and behavioural approaches. Evidence briefing. London: Health Development Agency, 2003. Available at http://www.nepho.org.uk/view_file.php?c=1612 (accessed August 2007).

[436] McLean N, Griffin S, Toney K, et al. Family involvement in weight control, weight maintenance and weight-loss interventions: a systematic review of randomised trials. Int J Obes. 2003;27(9):987-1005.

[437] Ogilvie D, Egan M, Hamilton V, Petticrew M. Promoting walking and cycling as an alternative to using cars: systematic review. BMJ, Oct 2004; 329: 763-768.

[438] Clemmens D, Hayman LL. Increasing activity to reduce obesity in adolescent girls: a research review. J Obstet Gynecol Neonatal Nurs. 2004;33(6):801-808.

[439] Carrel AL, Bernhardt DT. Exercise prescription for the prevention of obesity in adolescents. Curr Sports Med Rep. 2004;3(6):330-336.

[440] Miller YD & Dunstan DW. The effectiveness of physical activity interventions for the treatment of overweight and obesity and type 2 diabetes. *J Sci Med Sport,* 2004, 7 (Suppl 1):52-59.

[441] Casey L, Crumley E. Addressing Childhood Obesity: The Evidence for Action. Ottawa: Canadian Association of Paediatric Health Centres, 2004. Available at http://www.cihr-irsc.gc.ca/e/23293.html (accessed August 2007).

[442] Hayman LL, Williams CL, Daniels SR, et al. Cardiovascular health promotion in the schools: a statement for health and education professionals and child health advocates from the Committee on Atherosclerosis, Hypertension, and Obesity in Youth (AHOY) of the Council on Cardiovascular Disease in the Young, American Heart Association. Circulation 2004;110(15):2266-2275. Available at http://circ.ahajournals.org/cgi/content/full/110/15/2266 (accessed August 2007).

[443] Worsley A, Crawford D. Review of Children's Healthy Eating Interventions. Public Health Nutrition Evidence Based Health Promotion Research and Resource Project. Healthy eating programs for children ages 0-15 years. Melbourne: Deakin University, 2004.

[444] Hills AP & Byrne NM. Physical activity in the management of obesity. *Clin Dermatol*, 2004, 22:315-318.

[445] Jago R, Baranowski T. Non-curricular approaches for increasing physical activity in youth: a review. Prev Med. 2004;39(1):157-163.

[446] Hillsdon M, Foster C, Cavill N, Crombie H, Naidoo B. *The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews. Evidence briefing summary.* London: Health Development Agency, 2005.

[447] Muller MJ, Danielzik S, Pust S. School- and family-based interventions to prevent overweight in children. Proc Nutr Soc. 2005;64(2):249–254.

[448] Katz DL, O'Connell M, Yeh MC, et al. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. . *Morb Mortal Wkly Rep*, 2005, 7:1-12..

[449] Wareham NJ, van Sluijs EM, Ekelund U. Physical activity and obesity prevention: a review of the current evidence. Proc Nutr Soc. 2005;64(2):229-247.

[450] Ells LJ, Campbell K, Lidstone J, et al. Prevention of childhood obesity. Best Pract Res Clin Endocrinol Metab. 2005;19(3):441–454.

[451] LaMonte MJ et al. Physical activity and diabetes prevention. *J Appl Physiol*, 2005, 99:1205-1213.

[452] Koplan JP, Liverman CT, Kraak VA (eds). Preventing Childhood Obesity: Health in the Balance. Institute of Medicine Committee on Prevention of Obesity in Children and Youth. Wasington DC: The National Academies Press, 2005.

[453] Whitlock EP, Williams SB, Gold R, et al. Screening and interventions for childhood overweight: a summary of evidence for the US Preventive Services Task Force. Pediatrics. 2005;116(1):e125-144.

[454] US Preventive Services Task Force. Screening and interventions for overweight in children and adolescents: recommendation statement. Pediatrics 2005;116(1):205-209.

[455] Merten S, Dratva J, Ackermann-Liebrich U. Do baby-friendly hospitals influence breastfeeding duration on a national level? Pediatrics 2005;116(5):e702-708.

[456] Veugelers PJ, Fitzgerald AL. Effectiveness of school programs in preventing childhood obesity: a multilevel comparison. Am J Public Health 2005;95(3):432–435.

[457] Flynn MA, McNeil DA, Maloff B, et al. Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence with 'best practice' recommendations. Obes Rev. 2006;7(Suppl 1):7-66.

[458] Dyson L, Renfrew M, McFadden A, McCormick F, Herbert G, Thomas J. Promotion of breastfeeding initiation and duration Evidence into practice briefing. London: National Institute for Health and Clinical Excellence, 2006.

[459] Cavill N, Buxton K, Bull F, Foster C. Promotion of physical activity among adults Evidence into practice briefing. London: National Institute for Health and Clinical Excellence, 2006.

[460] D'Souza L, Renfrew M, McCormick F, Dyson L, Wright K, Henderson J, Thomas J. Food-support programmes for low-income and socially disadvantaged childbearing women in developed countries Systematic review of the evidence. London: National Institute for Health and Clinical Excellence, 2006.

[461] Foster C, Hillsdon M, Cavill N, Bull F, Buxton K, Crombie H. Interventions that use the environment to encourage physical activity. Evidence review. London: National Institute for Health and Clinical Excellence, 2006.

[462] NICE CG43 Obesity: guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children. Section 3 – Prevention: evidence statements and reviews. London: National Institute for Health and Clinical Excellence, 2006.
http://guidance.nice.org.uk/CG43/guidance

[463] French S A, Story M. Obesity Prevention in Schools. In Goran MI, Sothern MS (eds) Handbook of Pediatric Obesity: Etiology, Pathophysiology and Prevention. Boca Raton: CRC Taylor & Francis, 2006, pp 291-309.

[464] Doak CM, Visscher TLS, Renders CM, et al. The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes. Obes Rev. 2006;7(1):111-136.

[465] Cole K, Waldrop J, D'Auria J, et al. An integrative research review: effective school-based childhood overweight interventions. J Spec Pediatr Nurs. 2006;11(3):166-177.

[466] Flodmark CE, Marcus C, Britton M. Interventions to prevent obesity in children and adolescents: a systematic literature review. Int J Obes. 2006;30(4):579-589.

[467] National Institute for Health and Clinical Excellence (NICE). CG43 Obesity: Full guideline, section 3. Prevention: evidence statements and reviews. London: NICE, 2006. Available at http://guidance.nice.org.uk/CG43/guidance/section3/word/English (accessed August 2007).

[468] Story M, Kaphingst KM, French S. The Role of Schools in Obesity Prevention. In McLanahan S et al (eds) Childhood Obesity (special issue). The Future of Children, 2006;16(1):109-142.

[469] Story M, Kaphingst KM, French S. The Role of Child Care Settings in Obesity Prevention. In McLanahan S et al (eds) Childhood Obesity (special issue). The Future of Children, 2006;16(1):143-168.

[470] Lindsay AC, Sussner KM, Kim J, Gortmaker S. The Role of Parents in Preventing Childhood Obesity. In McLanahan S et al (eds) Childhood Obesity (special issue). The Future of Children, 2006;16(1):169-186.

[471] Sharma M. School-based interventions for childhood and adolescent obesity. Obes Rev. 2006;7(3):261-269.

[472] Shilton T, Bauman A, Bull F, Sarmiento O. Effectiveness and challenges for promoting physical activity globally. Chapter 7 in McQueen D, Jones C, (eds) *Global Perspectives on Health Promotion Effectiveness*. Vancouver, Springer, 2007 (on behalf of IUHPE, the International Union for Health Promotion and Education).

[473] Ogilvie D, Foster CE, Rothnie H, Cavill N, Hamilton V, Fitzsimons CF, Mutrie N; Scottish Physical Activity Research Collaboration. Interventions to promote walking: systematic review. BMJ. 2007 Jun 9;334(7605):1204.

[474] Sharma M. International school-based interventions for preventing obesity in children. Obes Rev. 2007;8(2):155-167.

[475] Katz DL, O'Connell M, Njike VY, et al. Strategies for the prevention and control of obesity in the school setting: systematic review and meta-analysis. Int J Obes. 2007 (Epub doi:10.1038/ sj.ijo.080368).

[476] Saunders KL Preventing obesity in pre-school children: a literature review. J Public Health (Oxf). 2007 Oct 3; [Epub ahead of print].

[477] Flodmark CE, Lissau I, Moreno LA, Pietrobelli A, Widhalm K. New insights into the field of children and adolescents' obesity: the European perspective. Int J Obes Relat Metab Disord. 2004 Oct;28(10):1189-96.

[478] Childhood obesity: screening and prevention. Synthesis and recommendations. Paris, Institut national de la santé et de la recherche médicale, 2000. http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=inserm2.chapter.267

[479] Prevention and Treatment of Obesity. Evidence-based Guideline of the Deutsche Diabetes Gesellschaft. Version 05/2007. http://www.deutsche-diabetes-gesellschaft.de/redaktion/mitteilungen/leitlinien/EBLL_ADIPOSITAS_Update_05_2007_ENGL.pdf

[480] SIGN 8: Obesity in Scotland: integrating prevention with weight management, 1998, revised 2005. www.sign.ac.uk/pdf/2005obesityreport.pdf

[481] NICE CG43 Obesity: guidance on the prevention, identification, assessment and management of overweight and obesity in adults and children. London: National Institute for Health and Clinical Excellence, 2006. http://guidance.nice.org.uk/CG43/guidance

[482] NICE. Four commonly used methods to increase physical activity: brief interventions in primary care, exercise referral schemes, pedometers and community-based exercise programmes for walking and cycling. London: National Institute for Health and Clinical Excellence, 2006.

[483] NICE. Draft Guidance to improve the nutrition of pregnant and breastfeeding mothers and children in low-income households. London: National Institute for Health and Clinical Excellence, 2007.

[484] NICE. Draft Guidance: Promoting and creating built or natural environments that encourage and support physical activity. London: National Institute for Health and Clinical Excellence, 2007.

,[485] Katz DL, O'Connell M, Yeh MC, et al. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. MMWR 2005;54(RR-10):1-12.

[486] Wareham NJ, van Sluijs EM, Ekelund U. Physical activity and obesity prevention: a review of the current evidence. Proc Nutr Soc. 2005;64(2):229-247.

[487] National Institute for Health and Clinical Excellence (NICE). CG43 Obesity: Full guideline, section 3. Prevention: evidence statements and reviews. London: NICE, 2006. Available at http://guidance.nice.org.uk/CG43/guidance/section3/word/English (accessed August 2007).

[488] Swedish Council on Technology Assessment in Health Care. Obesity – problems and interventions. Report No., 160. Stockholm: The Swedish Council on Technology Assessment in Health Care, 2002. Available at http://www.sbu.se/Filer/Content0/publikationer/1/obesity_2002/obsesityslut.pdf (accessed August 2007).

[489] Lobstein T, Swinburn B. Health promotion to prevent obesity: evidence and policy needs. Chapter 6 in McQueen D, Jones C (eds) Global Perspectives on Health Promotion Effectiveness. Vancouver: Springer, 2007.

[490] Katz D, O'Connell M, Njike VY, Yeh MC, Nawaz H. Strategies for the prevention and control of obesity in the school setting: systematic review and meta-analysis. *Int J Obes* 2007; Jul 31; [Epub ahead of print]

[491] Müller MJ, Danielzik S, Pust S. School- and family-based interventions to prevent overweight in children. Proc Nutr Soc. 2005 May;64(2):249-54.

[492] Müller MJ, Danielzik S, Landsberg B, Pust S. Interventions to prevent overweight in children. Int J Vitam Nutr Res. 2006 Jul;76(4):225-9.

[493] Danielzik S, Pust S, Landsberg B, Müller MJ First lessons from the Kiel Obesity Prevention Study (KOPS). Int J Obes (Lond). 2005 Sep;29 Suppl 2:S78-83.

[494] Singh AS, Chin A Paw MJ, Kremers SP, Visscher TL, Brug J, van Mechelen W. Design of the Dutch Obesity Intervention in Teenagers (NRG-DOiT): systematic development, implementation and evaluation of a school-based intervention aimed at the prevention of excessive weight gain in adolescents. BMC Public Health. 2006 Dec 16;6:304.

[495] Flynn MA, McNeil DA, Maloff B, Mutasingwa D, Wu M, Ford C, Tough SC. Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence with 'best practice' recommendations. Obes Rev. 2006 Feb;7 Suppl 1:7-66.

[496] Wen LM, Baur L, Rissel C, Wardle K, Alperstein G, Simpson JM. Early intervention of multiple home visits to prevent childhood obesity in a disadvantaged population: a home-based randomised controlled trial (Healthy Beginnings Trial). BMC Public Health. 2007; 7: 76. Published online 2007 May 10. doi: 10.1186/1471-2458-7-76.

[497] Lazzeri G, Casorelli A, Giallombardo D, Grasso A, Guidoni C, Menoni E, Giacchi M. Nutritional surveillance in Tuscany: maternal perception of nutritional status of 8-9 y-old school-children. J Prev Med Hyg. 2006 Mar;47(1):16-21.

[498] Yancey A. Tackling childhood obesity: Requires a shift in social norms, not just an exercise program. *BMJ.* 2006;**333**:1031–1032.

[499] Olds DL, Eckenrode J, Henderson CR, Kitzman J, Powers J, et al. Long-term effects of home visitation on maternal life course and child abuse and neglect. *JAMA.* 1997;**278**:673–643.

[500] Armstrong KL, Fraser JA, Dadds MR, Morris J. Promoting secure attachment, maternal mood and health in a vulnerable population: A randomised controlled trial. *J Paediatr Child Health.* 2000;**36**:555–62.

[501] Hodnett, ED.; Roberts, I. Home-based social support for socially disadvantaged mothers. *The Cochrane Database of Systematic Reviews.* Update 18 August 2001.

[502] NSW Government Families First. Early Intervention Survey Report. 2000.

[503] Stockley L. Toward public health nutrition strategies in the European Union to implement food based dietary guidelines and to enhance healthier lifestyles. Public Health Nutr. 2001 Apr;4(2A):307-24.

[504] Brunner E, Cohen D, Toon L. Cost effectiveness of cardiovascular disease prevention strategies: a perspective on EU food based dietary guidelines.Public Health Nutr. 2001 Apr;4(2B):711-5.

[505] Blitstein JL, Evans WD. Use of nutrition facts panels among adults who make household food purchasing decisions. J Nutr Educ Behav. 2006 Nov-Dec;38(6):360-4. Erratum in: J Nutr Educ Behav. 2007 Mar-Apr;39(2):104.

[506] Shepherd R and Towler G. Nutrition knowledge, attitudes and fat intake: application of the theory of reasoned action. *J Hum Nutr Diet* 1992 **5:**387–97.

[507] Stafleu A, Van Staveren WA, De Graaf C, *et al*. Nutrition knowledge and attitudes towards high-fat foods and low-fat alternatives in three generations of women. *Eur J Clin Nutr* 1996 **50:**33–41.[ISI][Medline]

[508] Burns CM, Richman R, Caterson ID. Nutrition knowledge in the obese and overweight. *Int J Obes* 1987 **11:**485–92.

[509] Kupper B, Krause P, Glaesmer H, *et al*. How do risk patients with overweight/obesity differ in their health knowledge and behaviour from patients with normal weight?—a primary care study. *Gesundheitswesen* 1996 **66:**361–9

[510] Reinehr T, Kersting M, Chahda C, *et al*. Nutritional knowledge of obese compared to non obese children. *Nutr Res* 2003 **23:**645–9.

[511] O'Dea JA, Wilson R.Socio-cognitive and nutritional factors associated with body mass index in children and adolescents: possibilities for childhood obesity prevention. Health Educ Res. 2006 Dec;21(6):796-805.

[512] Anderson AS. Nutrition interventions in women in low-income groups in the UK. Proceedings of the Nutrition Society (2007), 66, 25–32.

[513] Hanlon P . The Good Hearted Glasgow Campaign. In The Community Prevention of Coronary Heart Disease, pp. 181–187 [K William, editor]. Edinburgh: H. M. Stationery Office, 1992.

[514] Blamey A, Ayana M, Lawson L, Mackinnon J, Paterson I, Judge K. Final report: The independent evaluation of Have a Heart Paisley., 2005. https://www.scotland.gov.uk/Resource/Doc/37428/0012626.pdf

[515] Tudor Smith C, Nutbeam D, Moore L, Catford J. Effects of the Heartbeat Wales programme over five years on behavioural risks for cardiovascular disease: quasi-experimental comparison of results from Wales and a matched reference area. British Medical Journal 1998;316: 818–822.

[516] Baxter T, Milner P, Wilson K, Leaf M, Nicholl J, Freeman J, Cooper N. A cost effective, community based heart health promotion project in England: prospective comparative study. British Medical Journal, 1997; 315: 582–585.

[517] Dorner T, Fodor JG, Allichhammer D, Kiefer I, Lawrence K, D'Angelo MS, Huebel U, Strunz B, Ohnoutka A, Antes G, Schmidl H, Kunze M, Rieder A. "A heart for Vienna"--the prevention program for the big city. Blue-collar workers as a special target group. Wien Med Wochenschr. 2006 Oct;156(19-20):552-7.

[518] Marotta T, Viola S, Ferrara F, Ferrara LA. Improvement of cardiovascular risk profile in an elderly population of low social level: the ICON (Improving Cardiovascular risk profile in Older Neapolitans) study. J Hum Hypertens. 2007 Jan;21(1):76-85.

[519] Stead M, Caraher M, Wrieden W, Longbottom P, Valentine K, Anderson A. Confident, fearful and hopeless cooks: Findings from the development of a food-skills initiative. British Food Journal 2004; 106: 274–287.

[520] Wrieden WL, Anderson AS, Longbottom PJ, Valentine K, Stead M, Caraher M, Lang T, Gray B, Dowler E. The impact of a community-based food skills intervention on cooking confidence, food preparation methods and dietarychoices – an exploratory trial. Public Health Nutrition 2007; 10(2):203-11.

[521] Steptoe A, Perkins-Porras L, McKay C, Rink E, Hilton S, Cappuccio FP. Behavioural counselling to increase consumption of fruit and vegetables in low income adults: randomised trial. British Medical Journal 2003;326:855.

[522] Nelson M, Erens R, Bates B, Church S, Boshier T. Low Income Diet and Nutrition Survey: Summary of key findings. London: Food Standards Agency, 2007.

[523] Anderson AS. Nutrition interventions in women in low-income groups in the UK. Proceedings of the Nutrition Society (2007), 66, 25–32.

[524] Wrieden WL, Symon A. The development and pilot evaluation of a nutrition education intervention programme for pregnant teenage women (food for life). Journal of Human Nutrition and Dietetics 2003;16: 67–71.

[525] Dyson L, McCormick F & Renfrew MJ. Interventions for promoting the initiation of breastfeeding. The Cochrane Database of Systematic Reviews 2006;3, CD001688.

[526] Rajopal R, Cox RJ, Lambur M & Lewis EC. Cost-benefit analysis indicates the positive economic benefits of the Expanded Food and Nutrition Education Program related to chronic disease prevention. Journal of Nutrition Education and Behavior 2002; 34:26–37.

[527] Centers for Disease Control and Prevention. WISEWOMAN. A Crosscutting Program to Improve the Health of Uninsured Women. At a Glance, 2006. http://www.cdc.gov/nccdphp/publications/aag/wisewoman.htm

[528] Viadro CI, Farris RP & Will JC The WISEWOMAN projects: lessons learned from three states. Journal of Women's Health 2004; 13:529–538.

[529] Friel S. and C. Conlon. Food Poverty and Policy. April 2004, A report carried out for Combat Poverty Agency, Crosscare and the Society of St. Vincent de Paul http://www.cpa.ie/publications/FoodPovertyAndPolicy_2004.pdf accessed 30 May 2007

[530] Palmer G et al. Monitoring poverty and social exclusion in Scotland. Joseph Rowntree Foundation York 2006 http://www.jrf.org.uk/bookshop/eBooks/1993-poverty-Scotland-2006.pdf accessed 30 May 2007.

[531] Palmer. Ibid.

[532] Stables GJ, Young EM, Howerton MW, Yaroch AL, Kuester S, Solera MK, Cobb K, Nebeling L. Small school-based effectiveness trials increase vegetable and fruit consumption among youth. J Am Diet Assoc. 2005 Feb;105(2):252-6.

[533] Howerton MW, Bell BS, Dodd KW, Berrigan D, Stolzenberg-Solomon R, Nebeling L. School-based nutrition programs produced a moderate increase in fruit and vegetable consumption: meta and pooling analyses from 7 studies. J Nutr Educ Behav. 2007 Jul-Aug;39(4):186-96.

[534] Knai C, Pomerleau J, Lock K, McKee M. Getting children to eat more fruit and vegetables: a systematic review. Prev Med. 2006 Feb;42(2):85-95.

[535] Pomerleau J, Lock K, Knai C, McKee M. Interventions designed to increase adult fruit and vegetable intake can be effective: a systematic review of the literature. J Nutr. 2005 Oct;135(10):2486-95.

[536] Borys JM. EPODE - Together, we can prevent childhood obesity. Presentation at Community-based Obesity Prevention, Geelong, Australia, 1-2 September 2006. See http://www.flvs.fr and www.villesante.com/epode/epode_europe/index.htm.

[537] Increasing Children's Consumption of Fruit and Vegetables. Bangor Food and Activity Research Unit, University of Wales Bangor, UK (see http://www.fooddudes.co.uk/documents/research_summary.pdf page 3)

[538] Horne PJ, Tapper K, Lowe CF, Hardman CA, Jackson MC, Woolner J. Increasing children's fruit and vegetable consumption: a peer-modelling and rewards-based intervention. Eur J Clin Nutr. 2004 Dec;58(12):1649-60.

[539] Lowe CF, Horne PJ, Tapper K, Bowdery M, Egerton C. Effects of a peer modelling and rewards-based intervention to increase fruit and vegetable consumption in children. Eur J Clin Nutr. 2004 Mar;58(3):510-22.

[540] Anderson AS. Nutrition interventions in women in low-income groups in the UK. Proceedings of the Nutrition Society (2007), 66, 25–32.

[541] Graham H, Kelly MP. Health inequalities: concepts, frameworks and policy. Briefing Paper. London: NHS Health Development Agency, 2004.

[542] Potvin L, Mantoura P, Ridde V. Evaluating equity in health promotion. Chapter 21 in McQueen D, Jones C, (eds) *Global Perspectives on Health Promotion Effectiveness*. Vancouver, Springer, 2007 (on behalf of IUHPE, the International Union for Health Promotion and Education).

[543] Wardle J, Rapoport L, Miles A, Afuape T, Duman M. Mass education for obesity prevention: the penetration of the BBC's 'Fighting Fat, Fighting Fit' campaign. Health Education Research. 2001;16:343-55.

[544] Miles A, Rapoport L, Wardle J, Afuape T, Duman M. Using the mass-media to target obesity: an analysis of the characteristics and reported behaviour change of participants in the BBC's 'Fighting Fat, Fighting Fit' campaign. Health Education Research. 2001;16:357-72.

[545] Rychetnik L, Frommer M, Hawe P, Shiell A. Criteria for evaluating evidence on public health interventions. J Epidemiol Community Health 2002; 56(2):119-127

[546] Victora CG, Habicht JP, Bryce J. Evidence-based public health: moving beyond randomized trials. Am J Public Health 2004; 94(3):400-405.

[547] Green LW, Glasgow RE. Evaluating the relevance, generalization, and applicability of research: issues in external validation and translation methodology. Eval Health Prof 2006; 29(1):126-153.

[548] Swinburn B, Gill T, Kumanyika S. Obesity prevention: a proposed framework for translating evidence into action. Obes Rev. 2005 Feb;6(1):23-33.

[549] Lobstein T, Swinburn B. Health promotion to prevent obesity: Evidence and policy needs. Chapter 9 in McQueen D, Jones C, (eds) *Global Perspectives on Health Promotion Effectiveness*. Vancouver, Springer, 2007 (on behalf of IUHPE, the International Union for Health Promotion and Education).

[550] Hanmer J. & Hearn J. Gender and welfare research. In: Welfare Research: A Critical Review (eds F. Williams, J. Popay & A. Oakley), pp. 106–130. UCL Press Ltd: London 1999,

[551] Attree P. Low-income mothers, nutrition and health: a systematic review of the qualitative evidence. Maternal and Child Nutrition 2005; 1(4): 227-40

[552] Anderson, A., Nutrition interventions in women in low-income groups in the UK. Proc Nut Soc, 2007, 66:25-32.

[553] Attree P. Low-income mothers, nutrition and health: a systematic review of the qualitative evidence. Maternal and Child Nutrition 2005; 1(4): 227-40.

[554] www.sacn.gov.uk/pdfs/sacn_02_17.pdf

[555] ILO Up-to-date instruments concerning Maternity Protection Convention, 2000 (No. 183) and Maternity Protection Recommendation, 2000 (No. 191) http://www.ilo.org/ilolex/english/subjectE.htm#s14 accessed 31 May 2007.

[556] Britton C et al. Support for breastfeeding mothers. Cochrane Database Systematic Reviews 2007;(1):CD001141.

[557] Evidence for the ten steps to successful breastfeeding 1998 http://www.who.int/nutrition/publications/evidence_ten_step_eng.pdf accessed 31 May 2007.

[558] Review of the Scottish Diet Action Plan Progress and Impacts 1996-2005 NHS Health Scotland 2006 http://www.healthscotland.com/uploads/documents/3158-SDAP_Review_Report_Full.pdf accessed 30 May 2007.

[559] Szwajcer, E., et al. Nutrition awareness and pregnancy: Implications of the life course perspective. European Journal of Obstetrics and Gynecology doi:10.1016/j.ejogrb.2006.11.012 2006.

[560] Van Teijlingen, E., et al. Effectiveness of interventions to promote healthy eating in pregnant women and women of childbearing age: a review (review no. 11). 1998, Health Education Authority: London, UK.

[561] National Research Council and Institute of Medicine. Influence of Pregnancy Weight on Maternal and Child Health. Work shop report. Washington DC. 2007.

[562] Wilkinson, P., et al. Teenage conceptions, abortions, and births in England, 1994–2003, and the national teenage pregnancy strategy. Lancet, 2006, 368(9550):1879-1886.

[563] Harris, S. and C. Koukos, Sure Start: delivering a needs-led service in Swansea introduction the focus on play and stimulation helps. Community Practice, 2007, 80(2):24-7.

[564] http://www.healthylivingonline.org.uk/

[565] http://www.communityfoodandhealth.org.uk/

[566] www.wales.nhs.uk/sites3/home.cfm?orgid=499

[567] http://www.health-inequalities.eu/?uid=f74c703b85d9762ff38eaeef29782563&id=search3&sid=list&idx=53 accessed 31 May 2006.

[568] Kinnunen T, Luoto R, Gissler M, Hemminki E. Pregnancy weight gain from 1960s to 2000 in Finland. Int J Obesity 2003;27:1572-7.

[569] Feig, D. and C. Naylor, Eating for two: are guidelines for weight gain during pregnancy too liberal? Lancet, 1998, 351:1054-55.

[570] Kinnunen TI, Pasanen M, Aittasalo M, Fogelholm M, Hilakivi-Clarke L, Weiderpass E, Luoto R. Preventing excessive weight gain during pregnancy – a controlled trial in primary health care. Eur J Clin Nutr 2007;61:884-91.

[571] Polley BA, Wing RR, Sims CJ. Randomized controlled trial to prevent excessive weight gain in pregnant women. Int J Obes 2002;26:1494-1502.

[572] Wolff, S. PhD thesis Impact of Dietary Factors and Calorie Restriction on Excessive Gestational Weight Gain in Obese Women. The Royal Veterinary and Agriculture University, Denmark 2005.

[573] Althuizen, E., et al. Design of the New Life(style) study: a randomised controlled trial to optimise maternal weight development during pregnancy. BMC Public Health, 2006, 6:168-76.

[574] Kinnunen TI, Pasanen M, Aittasalo M, Fogelholm M, Weiderpass E, Luoto R. Reducing postpartum weight retention - a pilot trial in primary health care. Nutrition Journal 2007;6:21.

[575] Lovelady CA, Garner KE, Moreno KL, Williams JP. The effect of weight loss in overweight, lactating women on the growth of their infants. N Engl J Med 2000;342:449-453.

[576] Montgomery, K., Web Sites that Address Perinatal Physical Activity. J Perinat Educ, 2003, 12(2):47–49.

[577] National Institute fro Clinical Excellence, NICE. Antenatal care. Routine care for the healthy pregnant woman. www.nice.org.uk. 2003

[578] Davies, G., et al. Society of Obstetricians and gynecologists of Canada, SOGC Clinical Practice Obstetrics Committee. Joint SOGC/CSEP clinical practice guideline: exercise in pregnancy and the postpartum period. Can J Appl Physiol, 2003, 28(3):330-41.

[579] http://www.rcog.org.uk/resources/Public/pdf/exercise_pregnancy_rcog_statement4.pdf

[580] Artal, R. and M. O'Toole, Guidelines of the American College of Obstetricians and Gynecologists for exercise duringpregnancy and the postpartum period. Br J Sports Med, 2003, 37:6–12.

[581] Orskou J et al. Maternal characteristics and lifestyle factors and the risk of delivering high birth weight infants. Obstetrics and Gynecology 2003 Jul;102(1):115-20.

[582] Surkan PJ et al. Reasons for increasing trends in large for gestational age births. Obstetrics and Gynecology 2004 Oct;104(4):720-6.

[583] Villamor E, Cnattingus S. Interpregnancy weight change and risk of adverse pregnancy outcomes: a population study. Lancet 2006; 368: 1164-70.

[584] Heslehurst, N., et al. Trends in maternal obesity incidence rates, demographic predictors, and health inequalities in 36,821 women over a 15-year period. BJOG, 2007, 114(2):187-94.

[585] NICE public health guidance 6. Behaviour change at population, community and individual level. 2006. www.nice.org.uk.

[586] Heckman JJ, Skill Formation and the Economics of Investing in Disadvantaged Children. Science. 2006; 312: 1900-2.

[587] Inequalities in Health. Report of the Measuring Inequalities in Health Working Group 2003. http://www.scotland.gov.uk/Resource/Doc/47171/0013513.pdf accessed on 1 June 2007.

[588] Kristensen J et al. Pre-pregnancy weight and the risk of stillbirth and neonatal death. BJOG 2005;112:403-8.

[589] Baeten JM et al. Pregnancy complications and outcomes among overweight and obese nulliparous women. American Journal of Public Health 2001;91:436-440.

[590] Technical Note for the Spending Review 2004 Public Service Agreement 2005-2008 Dept of Health 2006 http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4138535.pdf accessed 1 June 2007.

[591] Synnott, K., et al. Parental perceptions of feeding practices in five European countries: an exploratory study. Eur J Clin Nutr, 2007,

[592] St Jeor ST et al: Family-based interventions for the treatment of childhood obesity. Journal of the American Dietetic Association, 2002, 102:640-644.

[593] Summerbell C et al. A systematic review of the effectiveness of interventions, including family interventions (in children aged 5 – 12), to prevent excess weight gain or maintain a healthy weight in children aged between two and five years. Obesity Guideline Development Group: Public Health Sub-Group. Middlesbrough, CPHE Collaborating Centre, University of Teesside, (in press).

[594] Tedstone et al. Effectiveness of interventions to promote healthy eating in preschool children aged 1 to 5 years: a review. London, Health Education Authority, 1998.

[595] McLean N et al. Family involvement in weight control, weight maintenance and weight-loss interventions: a systematic review of randomised trials. International Journal of Obesity and Related Metabolic Disorders, 2003, 27:987-1005.

[596] Hopper CA et al. School-based cardiovascular exercise and nutrition programs with parent participation. Journal of Health Education, 1996, 27:S32-S39.

[597] An Action Plan for improving oral health and modernising nhs dental services in Scotland 2005 http://www.scotland.gov.uk/Resource/Doc/37428/0012526.pdf accessed 31 May 2007.

[598] Heckman JJ, Skill Formation and the Economics of Investing in Disadvantaged Children. Science. 2006; 312: 1900-2.

[599] Stegeman, I. and C. Costongs, Promoting social inclusion and tackling health inequalities in Europe. An overview of good health practices from the health field. 2004, EuroHealthNet: Belgium. (http://eapn.horus.be/module/module_page/images/pdf/pdf_publication/Non-EAPN%20Publications/Goodpractices.pdf, accessed March 2007).

[600] Leurs, M.T., et al. Development of a collaborative model to improve school health promotion in The Netherlands. Health Promot Int, 2005, 20(3):296-305.

[601] Summerbell, C.D., et al. Interventions for preventing obesity in children. Cochrane Database Systematic Reviews 2005(3):CD001871.

[602] Flodmark C-E, Marcus C, Britton M. Interventions to prevent obesity in children and adolescents: a systematic literature review. International Journal of Obesity 2006; 30, 579-589.

[603] Flynn MA et al. Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence with 'best practice' recommendations. Obesity Reviews, 2006, 7 Suppl 1:7-66.

[604] Micucci S et al. The Effectiveness of School-Based Strategies for the Primary Prevention of Obesity and for Promoting Physical Activity and Nutrition, the Major Modifiable Risk Factors for Type 2 Diabetes: Review of Reviews. Hamilton, Public Health Research, Education and Development Program, 2002.

[605] Summerbell C et al. A systematic review of the effectiveness of interventions, including family interventions (in children aged 5 – 12), to prevent excess weight gain or maintain a healthy weight in children aged between two and five years. Obesity Guideline Development Group: Public Health Sub-Group. Middlesbrough, CPHE Collaborating Centre, University of Teesside, draft 2005.

[606] Scottish Consumer Council (2006). Guidelines on Commercial Activities in School. Scottish Consumer Council, Edinburgh. www.scotconsumer.org.uk

[607] http://www.euro.who.int/document/e90053.pdf

[608] Gray, G et al. Developing a health-promoting school. A practical resource for developing effective partnerships in school health, based on the experience of the European Network of Health Promoting Schools. 2006, World Health Organization, Council of Europe, European Commission: Copenhagen.

[609] Lister-Sharp D et al. Health promoting schools and health promotion in schools: two systematic reviews. Health Technol Assess 1999;**3**(22). http://www.hta.nhsweb.nhs.uk/fullmono/mon322.pdf

[610] Stewart-Brown, S. What is the evidence on school health promotion in improving health or preventing disease and, specifically, what is the effectiveness of the health promoting schools approach? Health Evidence Network. WHO, Copenhagen, 2006. (http://www.euro.who.int/Document/E88185.pdf, accessed June 2007)

[611] Dubois, L et al. Breakfast eating and overweight in a pre-school population: is there a link? Public Health Nutrition, 2006, 9(4):436-42.

[612] Belderson, P., et al. Does breakfast-club attendance affect schoolchildren's nutrient intake? A study of dietary intake at three schools. British Journal of Nutrition, 2003, 90(6):1003-6.

[613] Crepinsek, M., et al. Dietary effects of universal-free school breakfast: findings from the evaluation of the school breakfast program pilot project. Journal of the American Dietetic Association, 2006, 106(11):1796-803.

[614] Micucci, S et al. The Effectiveness of School-Based Strategies for the Primary Prevention of Obesity and for Promoting Physical Activity and Nutrition, the Major Modifiable Risk Factors for Type 2 Diabetes: Review of Reviews. 2002, Public Health Research, Education and Development Program: Hamilton, Canada.

[615] Gould, R et al. School lunch menus and 11 to 12 year old children's food choice in three secondary schools in England-are the nutritional standards being met? Appetite, 2006, 46(1):86-92.

[616] http://www.sustainweb.org/g5fp/index.htm; The Food in Schools Toolkit and website - www.foodinschools.org includes guidance on a whole school aproach and an interactive audit tool

[617] Food and nutrition policy for schools. A tool for the development of school nutrition programmes in the European Region. Document EUR/06/5073063. Copenhagen, WHO, 2006 (http://www.euro.who.int/Document/E89501.pdf)

[618] http://www.sustainweb.org/g5fp/index.htm; The Food in Schools Toolkit and website - www.foodinschools.org includes guidance on a whole school aproach and an interactive audit tool

[619] Press, V. and M. Mwatsama, Nutrition + food poverty. A toolkit for those involved in developing or implementing a local nutrition and food poverty strategy. 2004, National Heart Forum: London. (http://www.wmpho.org.uk/bulletin/pdf/334.pdf, access March 2007).

[620] Neumark-Sztainer, D et al. Correlates of fruit and vegetable intake among adolescents. Findings from project EAT. Preventive Medicine 2003;37:198-208

[621] Glanz K. Strategies for increasing fruit and vegetable intake in grocery stores and communities: policy, pricing, and environmental change. Preventive Medicine 2004;39:S75-S80

[622] Kubik MY et al. The association of the school food environment with dietary behaviors of young adolescents. American Journal of Public Health 2003;93(7):1168-1173

[623] French, S., et al. Pricing strategy to promote fruit and vegetable purchase in high school cafeterias. Journal of the American Dietetics Association , 1997, 97(9):1008-10.

[624] Goodman C, Anise A. What is known about the effectiveness of economic instruments to reduce consumption of foods high in saturated fats and other energy-dense foods for preventing and treating obesity? Copenhagen, WHO Regional Office for Europe, 2006 (http://www.euro.who.int/document/e88909.pdf, accessed 20 May 2007)

[625] Glanz, K. Strategies for increasing fruit and vegetable intake in grocery stores and communities: policy, pricing, and environmental change. Preventive Medicine 2004;39:S75-S80

[626] Knai, C., et al. Getting children to eat more fruit and vegetables: A systematic review. Preventive Medicine, 2006, 42(2):85-95.

[627] A healthy diet for good health - strategy plan for 2005 - 2009. 2005, National Council for Nutrition: Oslo. (http://www.shdir.no/vp/multimedia/archive/00007/IS-1259_Engelsk_7033a.pdf).

[628] Bere, E et al. Free school fruit - sustained effect 1 year later. Health Education Research 2006;21(2):268-75

[629] http://www.regjeringen.no/en/dep/hod/Documents/regpubl/stmeld/2006-2007/Report-No-20-2006-2007-to-the-Storting.html?id=466505&epslanguage=EN-GB.

[630] Amendments to the Regulations of the Cabinet of Ministers "Hygienic Requirements for General Primary and Secondary Education Institutions and Vocational Education Institutions", Latvia (accepted on August 22 2006, No.693).

[631] Amendments to the Regulations of the Cabinet of Ministers "Hygienic Requirements for Pre-school Education Institutions", Latvia (accepted on August 22 2006, No.692).

[632] Trudeau, F. and R.J. Shephard. Contribution of school programmes to physical activity levels and attitudes in children and adults. Sports Med, 2005, 35(2):89-105.

[633] Summerbell, C.D., et al. Interventions for preventing obesity in children. Cochrane Database Systematic Reviews 2005(3):CD001871.

[634] Jago R, Baranowski T. Non-curricular approaches for increasing physical activity in youth: a review. Preventive Medicine 2004, 39:157-163.

[635] Summerbell, C.D., et al. Interventions for preventing obesity in children. Cochrane Database Systematic Reviews 2005(3):CD001871.

[636] Racioppi, F., et al. A physically active life through everyday transport with a special focus on children and older people and examples and approaches from Europe. 2002, World Health Organization Regional Office for Europe: Copenhagen.

[637] Marks, A, Malizio, J, Hoch, J, Brody, R, Fisher, M. (1983) Assessment of health needs and willingness to utilize health care resources of adolescents in a suburban population. Journal of Pediatrics 102,456-460

[638] Gans, JE et al (1991) Adolescent Health Care: Use, Costs, and Problems of Access. American Medical Association Chicago, IL.

[639] Elster, AB, Kuznets NJ. AMA Guidelines for Adolescent Preventive Services (GAPS). Recommendations and Rationale. American Medical Association: Illinois, 1994.

[640] Feldman W, Beagan BL. Screening for Childhood Obesity. In: Canadian Task Force on the Periodic Health Examination. Canadian Guide to Clinical Health Care. Health Canada: Ottawa, 1994, 334-344. [http: //www.ctfphc.org/Full_Text_printable/Ch30full.htm]

[641] Beatty LA, Sigmon FL Jr. Well child care. In: Sloane PD, Slatt LM, Curtis P. (eds) Essentials of Family Medicine (2nd Edn). Williams & Wilkins: Baltimore, 1993 pp.131-139.

[642] Westwood, M, et al. Childhood obesity: should primary school children be routinely screened? A systematic review and discussion of the evidence. Arch Dis Child, 2007 May;92(5):416-22.

[643] Marks, A. Assessment of health needs and willingness to utilize health care resources of adolescents in a suburban population Journal of Pediatrics 1983, 102,456-460

[644] Hodgson, C et al. Adolescent health needs: utilization of health care by adolescents Adolescence 1986, 21:383-390

[645] Blum RW et al. Transition from child-centred to adult health-care systems for adolescents with chronic conditions: A position paper of the society for adolescent medicine. Journal of Adolescent Health 1993; 14: 570-576.

[646] Oppong-Odiseng ACK, Heycock EJ. Adolescent health services – through their own eyes. Arch Dis Child 1997; **77**: 115-119.

[647] Saelens BE et al. Behavioral weight control for overweight adolescents initiated in primary care. Obesity Research 2002; 10: 22-32.

[648] Caroli M, Burniat W. Dietary management. In Burniat W, Cole T, Lissau I, Poskitt EME. (eds) Child and adolescent obesity. Causes and consequences; Prevention and management. Cambridge University Press: Cambridge, 2002, 282-306.

[649] Parizkova J et al. Management through activity. In: Burniat W, Cole T, Lissau I, Poskitt EME (eds) Child and adolescent obesity. Causes and consequences; Prevention and management. Cambridge University Press: Cambridge, 2002, 307-326.

[650] Nuutinen O, Knip M. Predictors of weight reduction in obese children. European Journal of Clinical Nutrition 1992; 46: 785-794.

[651] Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year follow-up of behavioural, family-based treatment for obese children. JAMA 1990; 264: 2519-2523.

[652] Epstein LH. Methodological issues and ten-year outcomes for obese children. Ann NY Acad Sci 1993; 669: 237-249.

[653] Seidell, J et al. Cost-effective measures to prevent obesity: epidemiological basis and appropriate target groups. Proceedings of the Nutrition Society, 2005, 64(1):1-5.

[654] Press, V. and M. Mwatsama, Nutrition + food poverty. A toolkit for those involved in developing or implementing a local nutrition and food poverty strategy. 2004, National Heart Forum: London. (http://www.wmpho.org.uk/bulletin/pdf/334.pdf, access March 2007).

[655] European Community of Consumer Co-operatives, Diet, physical activity and health - a European platform for action Working group on informing consumer behaviour report. Report on education. European Community of Consumer Co-operatives: Brussels, 2005. (http://www.eurocoop.org/publications/en/memos/pdf/ReportV25oct05.pdf accessed 10 Jan 2006).

[656] Puska P. Successful prevention of non-communicable diseases: 25 year experiences with North Karelia project in Finland. Public Health Medicine 2002;4(1):5-7

[657] Katz DL et al. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. MMWR Recomm Rep, 2005, 54 RR-10:1-12. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5410a1.htm. accessed 12 March 2007.

[658] Titze, S., et al. A worksite intervention module encouraging the use of stairs: results and evaluation issues. http://www.hepa.ch/gf/gf_baspo/publications/Art_Titze_stairs_2001.pdf. Soz.- Präventivmed. , 2001, 46:013–019.

[659] Edwards, P. and A. Tsouros, Promoting physical activity and active living in urban environments. The role of local governments. 2006, World Health Organization: Copenhagen. (http://www.euro.who.int/document/e89498.pdf, access March 2007).

[660] www.die-praevention.de

[661] Powell, EC et al. Poor Neighborhoods: Safe Playgrounds. Journal of Urban Health 2005, 82(3):403-410.

[662] Painter, K., The influence of street lighting improvements on crime, fear and pedestrian street use, after dark. Landscape and urban planning 1996, 35:193-201.

[663] Fogelholm, M., et al. Rural–urban differences in health and health behaviour: A baseline description of a community health-promotion programme for the elderly. Scandinavian Journal of Public Health, 2006, 34(6):632–640.

[664] Clarke, G., H. Eyre, and C. Guy, Deriving Indicators of Access to Food Retail Provision in British Cities: Studies of Cardiff, Leeds and Bradford. Urban Studies, 2002, 39(11):2041-2060.

[665] Rex, D. and A. Blair, Unjust Des(s)erts: Food Retailing and Neighbourhood Health in Sandwell. International Journal of Retail and Distribution Management, 2003, 31(9):459-465.

[666] Kelly, F. and A. Parker, A Study of Retail Accessibility for Older People. The Elderly Poor and their Access to Grocery and Financial Services in Dublin. 2005, The Centre for Retail Studies, National University of Ireland: Dublin.

[667] Kaufman, P., Rural Poor Have Less Access to Supermarkets, Large Grocery Stores. Rural Development Perspectives, 1999, 13(3):19-26.

[668] Guy, C. and D. Bennison, Retail Planning Policy, Superstore Development and Retailer Competition. International Journal of Retail and Distribution Management, 2002, 30(9):431-434.

[669] Urban and peri-urban food and nutrition action plan. Elements for community action to promote social cohesion and reduce inequalities through Local Production for Local Consumption (Document EUR/01/5026040). 2001, WHO Regional Office for Europe: Copenhagen.

[670] Freathy, P., The Role of Voluntary Food Co-Operatives in the Retail Marketplace: Some Theoretical Considerations. The International Review of Retail Distribution and Consumer Research, 2003, 13(4):423-434.

[671] Finer N. Low-calorie diets and sustained weight loss. Obesity Research. 2001 Nov;9 Suppl 4:290S-294S

[672] Seidell, J et al. Cost-effective measures to prevent obesity: epidemiological basis and appropriate target groups. Proceedings of the Nutrition Society, 2005, 64(1):1-5.

[673] Swinburn BA et al. The green prescription study: a randomized controlled trial of written exercise advice provided by general practitioners. American Journal of Public Health, 1998, 88:288–291.

[674] Swinburn B et al. Green prescriptions doing well. New Zealand Medical Journal, 2000, 113:525

[675] Smith, B., et al. Promoting physical activity in general practice: a controlled trial of written advice and information materials. British Journal of Sports Medicine, 2000, 34:262-267.

[676] Morgan, O., Approaches to increase physical activity: reviewing the evidence for exercise-referral schemes. Public Health, 2005, 119(5):361-70.

[677] Gidlow, C., et al. Socio-demographic patterning of referral, uptake and attendance in Physical Activity Referral Schemes. Journal of Public Health (Oxf), 2007.

[678] Department of Health. Choosing Activity: a Physical Activity Action Plan. 2005, The Stationery Office: London.

[679] Nelson M et al. *Low Income Diet and Nurtrition Survey*. London: Food Standards Agency, 2007.

[680] Stegeman, I. and C. Costongs, Promoting social inclusion and tackling health inequalities in Europe. An overview of good health practices from the health field. 2004, EuroHealthNet: Belgium. (http://eapn.horus.be/module/module_page/images/pdf/pdf_publication/Non-EAPN%20Publications/Goodpractices.pdf, accessed March 2007).

[681] http://www.health-inequalities.eu/?uid=d5c4768ad414ed36ad7134a84ca6c279&id=main2

[682] Communities for Health: Learning from the Pilots. UK Department of Health, Health Inequalities Unit. 2007.

[683] Lobstein T, Millstone E. Policy options for responding to obesity: Summary report of the PorGrow project. Brighton, University of Sussex, 2006.

See http://www.sussex.ac.uk/spru/1-4-7-1-8.html, accessed 15 June 2007.

[684] EHN. Policy options to prevent child obesity: Stakeholder consultations carried out in the context of the project on Children Obesity and Associated Chronic Diseases. Brussels, European Heart Network, 2006.

See http://www.ehnheart.org/files/policy%20options%20final-150305A.pdf, accessed 15 June 2007.

[685] http://ec.europa.eu/employment_social/social_inclusion/naps_en.htm

[686] http://www.health-inequalities.eu

[687] Jurczak, K. et al, National Policies to Tackle Health Inequalities in Europe. Eurohealth 2005, 11(2).

[688] www.shdir.no/vp/multimedia/archive/00002/IS-1245_2905a.pdf

[689] http://www.regjeringen.no/en/dep/hod/Documents/regpubl/stmeld/2006-2007/Report-No-20-2006-2007-to-the-Storting.html?id=466505&epslanguage=EN-GB

[690] Comparative analysis of nutrition policies in the WHO European Region. A comparative analysis of nutrition policies and plans of action in WHO European Member States. May 2006. (Document EUR/06/5062700/BD/2) 2006, World Health Organization: Copenhagen. (http://www.euro.who.int/document/Nut/instanbul_conf_%20ebd02.pdf, accessed Jan 2007).

[691] http://europa.eu.int/comm/lisbon_strategy/index_en.html

[692] http://europa.eu.int/comm/lisbon_strategy/pdf/lisbon_en.pdf

[693] http://ec.europa.eu/health/ph_overview/strategy/health_strategy_en.htm

[694] Robertson A., The Implementation of Nutrition Policy in Scotland Compared with Twelve Other Countries. A Report for the Scottish Diet Action Plan Review Panel. 2005. Health Scotland, Edinburgh. Available: www.healthscotland.com accessed 31 May 2007.

[695] Lock, K et al. Health Impact Assessment of agriculture and food policies: lessons learnt from HIA development in the Republic of Slovenia. Bulletin of the WHO 2003, 6: 391-397.

[696] Review of the Scottish Diet Action Plan Progress and Impacts 1996-2005 NHS Health Scotland 2006 http://www.healthscotland.com/uploads/documents/3158-SDAP_Review_Report_Full.pdf accessed 30 May 2007.

[697] http://ec.europa.eu/employment_social/social_inclusion/index_en.htm

[698] http://ec.europa.eu/health/ph_determinants/life_style/nutrition/keydocs_nutrition_en.htm.

[699] http://ec.europa.eu/sport/index_en.html

[700] http://www.bmg.bund.de/cln_041/nn_1043648/DE/Themenschwerpunkte/Internationales/EU-Ratspraesidentschaft/Konferenzen/dossier-badenweiler,templateId=raw,property=publicationFile.pdf/dossier-badenweiler.pdf

[701] http://ec.europa.eu/health/ph_determinants/life_style/nutrition/platform/platform_en.htm

[702] http://ec.europa.eu/health/ph_determinants/life_style/nutrition/platform/docs/synopsis_commitments2007_en.pdf

[703] http://europa.eu.int/comm/health/ph_determinants/life_style/nutrition/platform/database/web/dsp_search

[704] Changing food lifestyles: Emerging consumer concerns. Paris: Organisation for Economic Co-operation and Development; 2004 19-21 October 2004. Report No.: AGR/CA/APM(2004)22.

[705] Mayor of London. Healthy and Sustainable Food for London. 2006, London Development Agency.

[706] National Strategy for Neighbourhood Renewal Improving Shopping Access for People Living in Deprived Neighbourhoods A Paper for Discussion. Policy Action Team: 13. (http://www.renewal.net/Documents/RNET/Policy%20Guidance/Improvingshoppingaccess.pdf accessed 5 April 2007). 2000, Department of Health: London.

[707] Summary: Accessing Healthy Food: A National Assessment and Sentinel Mapping Study of Food Retailing in Scotland. FSAS Project S04005. SFHC 37/2005. (http://www.scotland.gov.uk/Resource/Doc/1094/0019394.doc, accessed 5 April 2007).

[708] Robertson A. et al Food and health in Europe: a new basis for action. Copenhagen: World Health Organization; 2004.

[709] Cummins S et al. McDonald's restaurants and neighborhood deprivation in Scotland and England. American Journal of Preventive Medicine 2005;29(4):308-310.

[710] Cummins S, MacIntyre S. Food environments and obesity - neighbourhood or nation? International Journal of Epidemiology 2005;35:100-104.

[711] Cheadle A, Sterling T, Schmid T, Fawcett S. Promising community-level indicators for evaluating cardiovascular health-promotion programmes. Health Education Research 2000;15(1):109-116.

[712] NCC. Short-changed on health? How supermarkets can affect your chances of a healthy diet. London: National Consumer Council, 2006. See http://www.ncc.org.uk/food/short-changed.pdf, accessed 15 June 2007.

[713] Wrigley N, Warm D, Margetts B. Deprivation, diet, and food-retail access: findings from the Leeds "food deserts" study. Environment and planning 2003;35(1):151-188.

[714] Morgan, K. School Meals and Sustainable Food Chains: The Role of Creative Public Procurement. The Caroline Walker Lecture, given at the Royal Society, London. 2004. The Caroline Walker Trust.

[715] Morgan, K and Morley, A. Creating Sustainable Food Chains: Tapping the Potential of Positive Public Procurement, in M. Thomas and M. Rhisart (eds) Sustainable Regions 2004 Aureus Publishing, Cardiff.

[716] Review on legislations on housing and health. WHO Regional Office for Europe, in press

[717] Stahl T et al. The importance of the social environment for physically active lifestyle--results from an international study. Social Science Medicine, 2001, 52(1): 1-10)

[718] Dijkstra A et al. Best practice to promote cycling and walking. Analysis and development of new insights into substitution of short car trips by cycling and walking (ADONIS). Final report. Copenhagen, Danish Road Directorate, 1998

[719] Blamey, A et al. Health promotion by encouraged use of stairs. British Medical Journal, 1995, 311:289-290.

[720] Brownell, K.D et al. Evaluation and modification of exercise patterns in the natural environment. American Journal of Psychiatry, 1980. 137(12):1540-5.

[721] Charter on Transport, Environment and Health, WHO Regional Office for Europe (http://www.euro.who.int/document/peh-ehp/charter_transporte.pdf, accessed 25 May 2007

[722] The Office of Analysis, Nutrition and Evaluation, The Prevalence of Overweight Among WIC Children. Nutrition Assistance Program Report Series Report No. WIC-01-PCOM, United States Department of Agriculture Food and Nutrition Service, 2001. See http://www.fns.usda.gov/oane/MENU/Published/WIC/FILES/overwgt.pdf, accessed 15 June 2007.

[723] Shriel F., Conlon, C. Food Poverty and Policy http://www.cpa.ie/publications/FoodPovertyAndPolicy_2004.pdf accessed 30 May 2007.

[724] Low Income Project team. Low income, food, nutrition and health: strategies for improvement, A report for the Nutrition Task Force 1996, Department of Health: London.

[725] Leather, S. Less Money, Less Choice. In Your Food: Whose Choice? 1992, National Consumer Council: London.

[726] Combat Poverty Agency, Crosscare, Society of St Vincent de Paul 2005 http://www.cpa.ie/health/foodpoverty/hffai/2005_HFFAI_Sub_SocialPartnership.pdf accessed 30 May 2007.

[727] Review of the Scottish Diet Action Plan Progress and Impacts 1996-2005 NHS Health Scotland 2006 http://www.healthscotland.com/uploads/documents/3158-SDAP_Review_Report_Full.pdf accessed 30 May 2007.

[728] Regmi A et al. Cross-country analysis of food consumption patterns. Washington DC: Economic Research Service, USDA; 2001. Report No.: Agriculture and Trade Report WRS-01-1.

[729] Lobstein T, Millstone E. Policy options for responding to obesity: Summary report of the PorGrow project. Brighton, University of Sussex, 2006.

See http://www.sussex.ac.uk/spru/1-4-7-1-8.html, accessed 15 June 2007.

[730] Rayner, M., et al. Nutrient profiles: Development of Final Model: Final Report, December 2005, British Heart Foundation Health Promotion Research Group, Department of Public Health, University of Oxford. (http://www.food.gov.uk/healthiereating/advertisingtochildren/nutlab/nutprofmod, accessed 3 April 2007)

[731] Smed, S. and S. Denver. Taxing as economic tools in health policy. Paper presented to the 97th EAAE seminar: The Economics and Policy of Diet and Health, University of Reading, UK, 21-22 April 2005.

[732] Økonomiske virkemidler I ernæringspolitikken. Akademiet for de Tekniske Videnskaber, Copenhagen 2007. (english title: Economic nutrition policy measures: a useful tool in the challenge to combat obesity and poor nutrition? www.atv.dk.)

[733] Ministry of Health and Care Services. Report No. 20 to the Storting (2006-2007). *National strategy to reduce social inequalities in health*. Oslo, 2007. http://www.regjeringen.no/en/dep/hod/Documents/regpubl/stmeld/2006-2007/Report-No-20-2006-2007-to-the-Storting.html?id=466505&epslanguage=EN-GB accessed 24 Oct 2007.

[734] Ibid (Ministry of Health and Care Services 2007), page 60.

[735] Goodman C, Anise A. What is known about the effectiveness of economic instruments to reduce consumption of foods high in saturated fats and other energy-dense foods for preventing and treating obesity? Copenhagen, WHO Regional Office for Europe, 2006 (http://www.euro.who.int/document/e88909.pdf, accessed 20 May 2007)

[736] A systematic review of the research on consumer understanding of nutrition labelling. Brussels: European Heart Network; 2003. http://www.ehnheart.org/files/consumer%20nutrition-143058A.pdf accessed 26 May 2007.

[737] Hersey JC et al. Food shopping practices are associated with dietary quality in low-income households. Journal of Nutrition Education 2001; 33, Supp 1 S16-S27.

[738] McArthur L et al. Behaviors, attitudes, and knowledge of low-income consumers regarding nutrition labels. Journal of Health Care for the Poor and Underserved 2001; 12 (4) 415- 428.

[739] The introduction of mandatory labelling in the European Union. Impact assessment undertaken for DG Sanco, European Commission. Brussels: European Advisory Services (EAS); 2004.

[740] Report on European Consumers´ Perception of Foodstuffs Labelling. Results of Consumer research conducted on behalf of BEUC from February to April 2005. Brussels: The European Consumers´ Organisation, (BEUC); 2005. Report No.: BEUC/X/032/2005.

[741] A simplified labelling scheme. Brussels: The European Consumers´ Organisation (BEUC); 2005. Report No.: BEUC/X/031/2005.

[742] Labelling: competitiveness, consumer information and better regulation for the EU. A DG SANCO Consultative Document. February 2006.

[743] Sustain: the alliance for better food and farming. Children's Food Campaign fact-sheet: food labelling. London, Sustain, January 2007. (http://www.sustainweb.org/news.php?id=169, accessed 3 April 2007).

[744] Lobstein, T., J. Landon, and P. Lincoln, Misconceptions and misinformation: The problems with Guideline Daily Amounts (GDAs) 2007, National Heart Forum: London. (http://www.heartforum.org.uk/downloads/NHFGDAreport.pdf accessed 3 April 2007).

[745] Why Traffic Light Labels Work Best for Consumers. Briefing, January 2007. Which? – UK Consumers Association, 2007. (http://www.which.co.uk/files/application/pdf/Traffic%20lights%20briefing%20Webversion%20Jan%2007-445-105274.pdf accessed 3 April 2007).

[746] Terms of reference and conduct of business for the signpost evaluation project management panel. 9 March 2007. Food Standards Agency: London. (http://www.food.gov.uk/foodlabelling/signposting/signpostevaluation/signpostevalterms, accessed 5 April 2007).

[747] Golan E, F et al. Economics of food labelling. Agriculture Economic Report No. 793. Washington DG, Economic Research Service, US Dept. of Agriculture 2000.

[748] Lobstein, T et al. Misconceptions and misinformation: The problems with Guideline Daily Amounts (GDAs) 2007, National Heart Forum: London. (http://www.heartforum.org.uk/downloads/NHFGDAreport.pdf accessed 3 April 2007).

[749] European Commission. *A strategy for Europe on Nutrition, Overweight and Obesity Related Issues*. Brussels: DG Sanco, 2007. http://ec.europa.eu/health/ph_determinants/life_style/nutrition/keydocs_nutrition_en.htm

[750] Mayo, E. *Shopping generation*. London: National Consumer Council, 2005.

[751] van Reek J et al. Policy elements as predictors of smoking and drinking behaviour: the Dutch Cohort Study of secondary schoolchildren. Health Policy 1993, 26(1):5-18.

[752] Marketing of Food and Non-Alcoholic Beverages to Children, WHO, Geneva 2007 http://www.who.int/dietphysicalactivity/publications/Oslo%20meeting%20layout%2027%20NOVEMBER.pdf accessed 30 May 2007.

[753] Hastings, G et al et al. (September 2003). Review of research on the effects of food promotion to children. Commissioned by the Food Standards Agency (FSA). http://www.foodstandards.gov.uk/multimedia/pdfs/promofoodchildrenexec.pdf accessed 31 May 2007.

[754] A commentary on the researcy evidence regarding the effects of food promotion on children 2004 http://www.ofcom.org.uk/research/tv/reports/food_ads/appendix1.pdf accessed 26 May 2007.

[755] http://www.who.int/nutrition/publications/code_english.pdf accessed 31 May 2007.

[756] www.health.vic.au/healthpromotion/downloads/ace_obesity.pdf accessed 25 May 2007

[757] http://www.cap.org.uk/NR/rdonlyres/91E31133-6A77-4AF6-9A6F-6DB593BDF3EA/0/CAP_Code_Food_SoftDrink_Ads_Children.pdf accessed 26 May 07.

[758] http://news.bbc.co.uk/1/hi/health/6154600.stm.

[759] World Health Organization. Marketing of Food and Non-Alcoholic Beverages to Children, WHO, Geneva 2007 http://www.who.int/dietphysicalactivity/publications/Oslo%20meeting%20layout%2027%20NOVEMBER.pdf accessed 30 May 2007.

[760] World Health Organization. Ibid.

[761] WHO. *European Charter on counteracting obesity*. World Health Organization Regional Office for Europe. EUR/06/5062700/8, 16 November 2006. http://www.euro.who.int/Document/E89567.pdf accessed 24 Oct 2007.

[762] WHA, Revised resolution on the Prevention and Control of Noncommunicable Diseases: Implementation of the Global Strategy. 60th World Health Assembly, Geneva, May 2007. http://www.who.int/gb/ebwha/pdf_files/WHA60/A60_R23-en.pdf

[763] http://ec.europa.eu/health/ph_determinants/life_style/nutrition/keydocs_nutrition_en.htm.

[764] http://www.who.int/child-adolescent-health/NUTRITION/global_strategy.htm accessed 1 June 2007.

[765] Protection, promotion and support of breastfeeding in Europe: a blueprint for action. 2004. www.breastfeedingmanifesto.org.uk/doc/publication/Blueprint_1162501967.pdf. accessed 18 June 2007.

[766] Infant and Young Child Feeding: Standard Recommendations for the European Union 2006 http://ilca.org/liasion/Infant-and-YoungChildFeeding/EUPolicy06English.pdf [766] http://www.burlo.trieste.it/old_site/Burlo%20English%20version/Activities/EUpolicy06.pdf accessed 8 October 2007.

[767] Vaandrager, H. and M. Koelen, Consumer involvement in nutritional issues: the role of information. American Journal of Clinical Nutrition, 1997, 65(Suppl):1980S-4s.

[768] Johnson, D. and R. Johnson, The process of nutrition education: a model. Journal of Nutrition Education 1985, 17(2, Suppl 1):S1-S7.

[769] Contento, I., The effectiveness of nutrition education and implications for nutrition education policy, programs, and research: a review of research. Journal of Nutrition Education 1995, 27(6):277−418.

[770] Ibid.

[771] Fortmann, S. and A. Varady, Effects of a community-wide health education program on cardiovascular disease morbidity and mortality: the Stanford Five-City Project American Journal of Epidemiology, 2000, 152(4):316-23.

[772] Puska, P., Nutrition and mortality: the Finnish experience. Acta Cardiologica 2000, 55(4):213-220.

[773] Pomerleau, J., et al. A systematic review of interventions designed to increase adult fruit and vegetable intake. Journal of Nutrition, 2005, 135:2486-2495.

[774] Knai, C., et al. Getting children to eat more fruit and vegetables: A systematic review. Preventive Medicine, 2006, 42(2):85-95.

[775] Knai, C., et al. Effectiveness of physical activity promotion strategies, in: The obesity issue in Europe: status, challenges, prospects. Copenhagen, World Health Organization, Regional Office for Europe (in press).

[776] Vaandrager, H. and M. Koelen, Consumer involvement in nutritional issues: the role of information. American Journal of Clinical Nutrition, 1997, 65(Suppl):1980S-4s.

[777] Lobstein, T., Prevention of child obesity: practical issues. WHO Expert Consultation on childhood obesity. Kobe, Japan 20-24 June 2005. Draft. 2005.

[778] Nanny or Steward? The role of government in public health. Kings Fund, London. 2005 http://www.kingsfund.org.uk/publications/kings_fund_publications/nanny_or.html accessed 10 June 2007.

[779] Er Sundhed et personligt valg? - et debatoplæg om forebyggelse i Danmark. Huset Mandag Morgen og TrygFonden, Denmark 2006. www.trygfonden.dk/Admin/Public/DWSDownload.aspx?File=Files%2FFiler%2FEr_sundhed_et_personligt_valg.pdf accessed 10 June 2007.

[780] Health Cities Project: a Project becomes a movement. 1990, World Health Organization: Copenhagen.

[781] The Ottawa Charter Online from: http://www.ldb.org/iuhpe/ottawa.htm.

[782] Rabiee, F., Sustainability in local public health nutrition programmes: beyond nutrition education, towards community collaboration. Proceedings of the Nutrition Society, 2006, 65(4):418-28.

[783] Kennedy LA. Community involvement at what cost?—local appraisal of a pan-European nutrition promotion programme in low-income neighbourhoods. Health Promotion International 2001;16(1), 35-45.

[784] Towards a Conceptual Framework for Analysis and Action on the Social Determinants of Health. Discussion paper for the Commission on Social Determinants of Health DRAFT 5 May 2005. WHO, Commission secretariat, WHO Health Equity Team, Office of the Assistant Director-General, Evidence and Information for Policy Cluster: Geneva, 2005. (http://ftp.who.int/eip/commision/Cairo/Meeting/CSDH%20Doc%202%20-%20Conceptual%20framework.pdf)

[785] Olson, CM and Strawderman, MS. Modifiable behavioural factors in a biopsychosocial model predict inadequate and excessive gestational weight gain. Journal of the American Dietetics Association 2003;103(1):48-54.

[786] National Research Council and Institute of Medicine. Influence of Pregnancy Weight on Maternal and Child Health. Work shop report. Washington DC. 2007.

[787] Government Office for Science. *Tackling obesities: Future Choices Project.* Department for Innovation, Universities and Skills, 2007. http://www.foresight.gov.uk/Obesity/Obesity.htm accessed 24 October 2007.

[788] World Health Organization. Health Impact Assessment (HIA). http://www.who.int/hia/en/ accessed 24 Oct 2007.

[789] National Health Services. Health Impact Assessment Gateway. http://www.hiagateway.org.uk/ accessed 24 Oct 2007.

[790] http://ec.europa.eu/health/ph_determinants/life_style/nutrition/keydocs_nutrition_en.htm

[791] Review of the Scottish Diet Action Plan Progress and Impacts 1996-2005 NHS Health Scotland 2006 http://www.healthscotland.com/uploads/documents/3158-SDAP_Review_Report_Full.pdf accessed 30 May 2007.

[792] http://www.food.gov.uk/science/dietarysurveys/lidnsbranch/ accessed on 5 June 2007

[793] http://www.scotland.gov.uk/Topics/Statistics/SIMD/Overview, accessed on 7 June 2007

[794] Crombie et al. Public Health Policy to tackle obesity: An International Perspective 2005 http://www.healthscotland.com/uploads/documents/obesity_full_report.pdf accessed 8 June 2007

[795] Boseley S. Date for halting childhood obesity slips back 10 years. The Guardian, 17 October 2007. http://society.guardian.co.uk/health/story/0,,2192574,00.html accessed 24 Oct 2007.

[796] Scottish Executive. Delivering a Healthy Scotland: Meeting the Challenge. Edinburgh, 2006. http://www.scotland.gov.uk/Resource/Doc/156928/0042202.pdf accessed 7 June 2007.

[797] Review of the Scottish Diet Action Plan. Progress and Impacts 1996-2005. NHS Health Scotland, 2006 (http://www.healthscotland.com/uploads/documents/3158-SDAP_Review_Report_Full.pdf accessed 30 May 2007).

[798] Hawe P, Shiell A. Preserving innovation under increasing accountability pressures: the health promotion investment portfolio approach. Health Prom Aust, 1995, 5:4-9.

[799] Swinburn B, Gill T. 'Best investments' to address child obesity: A scoping exercise. Sydney, Centre for Public Health Nutrition, and Melbourne, Deakin University, 2004.

[800] Swinburn B, Gill T, Kumanyika S. Obesity prevention: a proposed framework for translating evidence into action. Obes Rev, 2005, 6:23–33

[801] Katz DL, O'Connell M, et al. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. MMWR Recomm Rep, 2005, 54 RR-10:1-12. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5410a1.htm accessed 12 March 2007.

[802] Wang LY, Yang Q, Lowry R, Wechsler H. Economic analysis of a school-based obesity prevention program. Obes Res, 2003, 11:1313–1324.

[803] Department of Human Services. ACE-Obesity: Assessing Cost-Effectiveness of obesity interventions in children and adults: Summary of Results. Victorian Government, Melbourne, Sept 2006, Published online at www.health.vic.gov.au/healthpromotion/downloads/ace_obesity.pdf (accessed 25 February 2007).

[804] Haby MM, Vos T, Carter R, Moodie M, Markwick A, Magnus A, Tay-Teo KS, Swinburn B. A new approach to assessing the health benefit from obesity interventions in children and adolescents: the assessing cost-effectiveness in obesity project. Int J Obes 2006, 30: 1463–1475.