



Prevention of Obesity in Europe – Consortium for the prevention of obesity through effective nutrition and physical activity actions – EURO-PREVOB

Tackling the social and economic determinants of nutrition and physical activity for the prevention of obesity across Europe

D3.2: Review of previous and existing actions, initiatives, policies on nutrition and physical activity

by

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& The EURO-PREVOB Consortium

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Prevention of Obesity in Europe
Consortium for the prevention of
obesity through effective nutrition
and physical activity



SIXTH FRAMEWORK PROGRAMME

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Abstract

Within the context of the EURO-PREVOB project, WP3 aims to present a review of reviews of policies and interventions to support the methodology for the pilot testing of the EURO-PREVOB policy analysis tool. This document presents a final draft of this review.

List of abbreviations and glossary

The following abbreviations are used in this report:

BFHI	Baby Friendly Hospital Initiative	GDAs	Guideline daily amounts
BMI	Body mass index	HDI	Human development index
CEMACH	Confidential Enquiry into Maternal and Child Health	HLC	Health Living Centres
DG SANCO	EU Directorate General for Health and Consumer Protection	IOM	Institute of Medicine
EC	European Commission	NICE	National Institutes for Health and Clinical Excellence
EU	European Union	NGO	Nongovernmental organisations
EURO-PREVOB	Prevention of Obesity in Europe – Consortium for the prevention of obesity through effective nutrition and physical activity actions	SES	Socioeconomic status
EFSA	European Food Safety Agency	SEG	Socioeconomic groups
FNAP	Food and Nutrition Action Plan	UNICEF	United Nations Children’s Fund
		WHO	World Health Organization
		WP	Workpackage

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Introduction

Obesity in many respects can be considered to be a result of policies that influence both dietary intake and physical activity, positively or negatively. Therefore governments, at the same time as focusing on individual risk factors, must consider which policies seek to protect, support and promote environmental influences that are conducive to health equalities and obesity prevention. This EURO-PREVOB review considers a number of population-wide approaches (macro-level) to public health in addition, to targeted interventions that protect vulnerable groups in specific settings (micro-level).

There is a need to explore and better understand the key determinants of obesity within a socioeconomic framework that can better explain the social gradient in obesity prevalence. Intuitively it is hard to understand how disadvantaged groups can suffer from obesity. For example, what determines the high prevalence of obesity within disadvantaged families, who have little money and restricted food budgets.

The social gradient in obesity is probably determined by many different factors depending on a range of environmental contexts. Below is a list of selected physiological, dietary, physical activity and psychological and cultural determinants that also exhibit a social gradient:

- Physiological factors: high parental, especially maternal, weight; greater maternal weight gain during pregnancy; poor weight loss after pregnancy; unhealthy birth-weight (low and high); poor dental health.
- Dietary factors: low-income households eat less well and have poorer quality foods and lower compliance with dietary recommendations and nutrient intake; little or no breastfeeding, early weaning; higher sugar-containing soft-drink consumption; lower vegetable and fruit intake; more vulnerable to food marketing; missing breakfast; low-income households, while spending a relatively higher share of income on food, have difficulties accessing a variety of good quality, affordable food.
- Physical activity factors: lower physical activity levels; more TV watching and sedentary activities; less access to facilities that support physical activity.
- Psychological and cultural factors: low-income households are restricted socially and culturally in their food choices due to financial and physical constraints and psychological needs; low self-esteem and behavioural problems; low-income households often know what the healthy food options are.

Within the food environment the concept of food and nutrition security emphasises that dietary intake must supply nutrition security in addition, to energy to satisfy hunger. Thus availability and access to a diet rich in vitamins, minerals, anti-oxidants, phyto-chemicals and other essential nutrients, in addition, to energy, should be assured for all, especially disadvantaged groups. For example, obese children, especially those living in 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, such as fruits and vegetables. Food and

nutrition 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.

Similarly within the physical activity environment all people, at all times, should have physical, social and economic access to a safe environment and availability of appropriate facilities to meet their exercise needs for an active and healthy life.

The aim of this review is to summarise the evidence of the effectiveness of policies and interventions. The first objective is to provide an overview of existing nutrition and physical activity intervention and policy research, focusing on both the population (macro) and subpopulations (micro) levels, to prevent obesity. The review is not exhaustive or quantitative, as each area has been reviewed in more depth in other reports. Instead, the objective is to provide one single document that presents a qualitative overview of the state of policy and intervention research until the beginning of 2008.

The second objective is to offer an approach to improve the state of policy and intervention evaluation and to propose some practice-based evidence to help bridge the gaps between policy and implementation of successful interventions. A range of health protection policies and interventions are needed to change the obesogenic environment into an environment that protects and supports food and nutrition security and access to physical activity.

A combined up- and downstream approach aims to protect and support the consumer and enable them to more easily make healthy choices. This combined approach will be the most effective way to reach the “hard to reach”. The rationale for the process of the selection of the EURO-PREVOB priority areas is detailed in the EURO-PREVOB workpackage 2 (WP2), which summarises the recommendations listed in recent WHO and EU policies documents and endorsed by Member States. These areas reflect the policies being instigated at EU and national level. The EURO-PREVOB priority areas are not exhaustive (e.g. workplace interventions; and interventions to improve dietary intake are not included). The overall consensus within EURO-PREVOB was to include some of the most investigated opportunities being explored, especially via health protection strategies, to prevent obesity. The aim is to create an evidence-base for multiple strategies that could contribute to a comprehensive obesity prevention policy.

Seven areas (as illustrated in Figure 1) have been selected by the EURO-PREVOB Consortium for improving the population-wide impact to reduce levels of obesity. In synthesising this vast literature, the most recent reviews of interventions related to, at the macro-level, the food environment and the physical activity environment along with, at the micro-level, downstream settings such as services for families and children. Later, in the discussion sections within each area, other reports or studies are included to expand the research base and provide promising new areas for intervention.

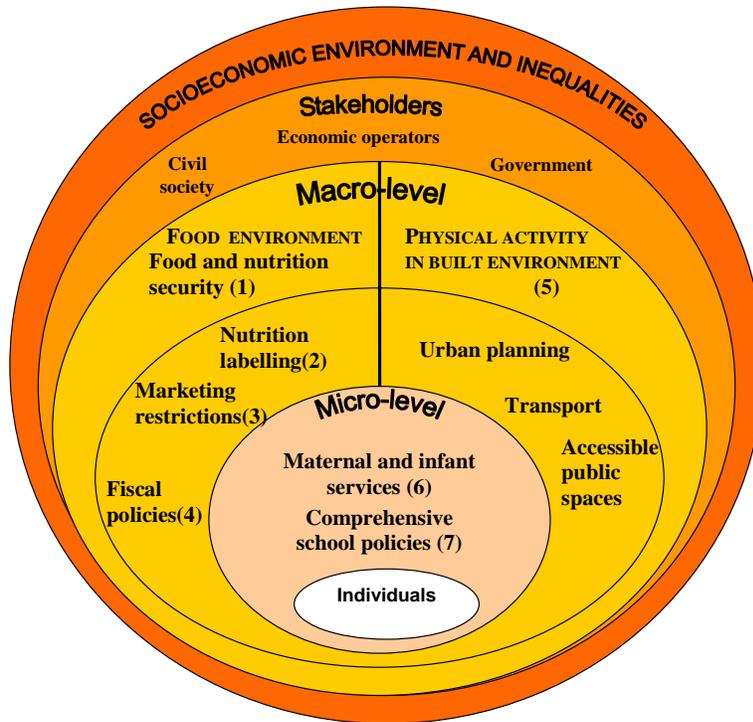


Figure 1. EURO-PREVOB selected seven policy areas to reduce obesity

The food environment (Figure 1) includes: food and nutrition security; front-of-pack nutrition labelling on packaged foods; regulations on marketing unhealthy food and beverages to children; and taxation of unhealthy food and subsidising healthy food. Similarly the macro-level physical activity environment (Figure 1) includes: planning, especially in urban areas; transport; and accessible public spaces. At the micro-level interventions at critical entry points during the life course (i.e. families with young children, and school-children and adolescents) are reviewed. These micro-level (downstream) interventions consist of initiatives that include determinants of both dietary and physical activity patterns.

This review provides evidence on which to base policies and interventions to prevent obesity. Questions about the strength of the “evidence based” for prevention policy and interventions can be legitimately raised. The highest level of evidence of clinical effectiveness comes from systematic reviews of randomised controlled trials. Many systematic reviews are of direct relevance to the EURO-PREVOB priority areas highlighted and have been cited. However, many of the areas addressed have not been, and cannot be, addressed by randomised controlled trials (e.g. promotion and marketing of unhealthy food and beverages to children or differentiated VAT on healthy versus unhealthy foods). This highlights the limitations of randomised controlled trials and some population health issues may be better illuminated by observational studies than by controlled trials. Possibly the best evidence on environmental determinants is the evaluation of “natural experiments” or quasi-experimental trials. To enable these to be carried out we need reliable indicators. The EURO-PREVOB project presents an attempt to develop such indicators.

The many causes of obesity are so complex and numerous that prevention options will probably never be subjected to randomised controlled trials. Inevitably, recommendations in the future will probably rely on different types of evidence, and more frequently on “expert opinion”. This does not mean that this review is not evidence-based, merely that the evidence cannot be in the form of randomised controlled trials or case control studies alone due to either the unavailability or inappropriate application of these.

1. Methods

The methods used to identify existing reviews of the literature and the latest key scientific articles are described below.

2.1 Search strategy

A series of comprehensive reviews have recently been commissioned by European agencies and organisations such as the European Commission, the World Health Organization Regional Office for Europe and individual European governments to provide the scientific background for how countries can best respond to obesity. In light of the mandate of this EURO-PREVOB work-package (WP3), this reviews starts from the premise that the core findings have already been reviewed and documented in major WHO, EU and UK (Foresight) funded reports (as cited in EURO-PREVOB deliverable “D3.1 - Review of the literature of obesity (and inequalities in obesity) in Europe and of its main determinants: nutrition and physical activity”). Therefore only the most recent reviews (mainly from 2007) are cited in this present document. In some cases earlier academic reviews are cited to provide a more holistic picture of the state of the evidence (e.g. with regard to the association between nutrition insecurity and obesity).

The Cochrane Library and PUBMED reviews were searched from November 2006 to January 2008 along with the websites from government agencies and relevant international organisations. The search was limited to human studies and not animals; English language.

Details of all reviews and reports are provided in Annex 1.

The general free text terms used included [(obes* OR overweight*) AND (inequal* OR inequ* OR poverty OR socioeconomic OR sedentar* OR econom* OR cost* OR burden* OR nutriti* OR physical activity OR physical inactivity OR transport* OR diet*) AND Europ*].

Specific text terms were used for specific policies and interventions relating to nutrition and physical activity are in accordance with Figure 1.

For “food and nutrition insecurity” a search was carried out using the following specific terms: [(food OR nutrition security) AND (income* OR inequ* OR poverty OR deprivation OR disadvantaged) AND (budget* OR price* OR cost) AND Europ*].

For “front-of-pack nutrition labelling” a search was carried out using the following terms: [(nutrition* OR food) AND (label OR labelling OR labeling) AND (banding OR signposting OR “point of purchase” OR “front of pack” OR “traffic lights”)].

For “promotion and marketing” a search was carried out using the following terms: [(nutrition* OR food) AND (marketing OR advert* OR commercial* OR branding) AND (regulat* OR “code of practice”)].

For “economic tools” a search was carried out using the following terms: [(nutrition* OR food) AND (tax OR VAT OR subsidy)].

For “physical activity” a search was carried out using the following terms: [(obes* OR overweight*) AND (sedentar* OR physical activity OR physical inactivity OR transport*) AND Europ*].

For “maternal and young child health” a search was carried out using the following terms: [(obes* OR overweight*) AND (pregnan* OR “breastfeeding” OR lactation*) AND Europ*].

For “comprehensive school policies” a search was carried out using the following terms: [(obes* OR overweight*) AND (child* OR school* OR “healthy eating” OR sedentar* OR "physical activity" OR "physical inactivity") AND Europ*].

This review is guided by Figure 1 above. The key reviews found relating to the seven EURO-PREVOB priority areas are presented in table format in Annex 1, and the tables include brief summaries for each review or report cited.

3. Summary of results and recent reviews within the environment of nutrition and physical activity

Table 3.1 below is a summary table containing a review of all the papers and reports described in the tables in Annex 1. This summary table is guided by the EUR-PREVOB priority areas: food and nutrition insecurity; front-of-pack labelling; promotion and marketing; fiscal policies; physical activity – policies and interventions at macro- and micro-level; maternal and infant services; and preschool and school services.

Overall a total of 50 reviews are cited for this EURO-PREVOB review, along with 2 governmental reports, 1 technical report, and 1 scientific paper.

Within the food and nutrition environment a total of 21 reviews are cited (food and nutrition insecurity (12); front-of-pack labelling (5); and promotion and marketing (4)). In addition, 1 governmental report, 1 technical report and 1 scientific paper address fiscal policies, a EURO-PREVOB priority area, where there is the least published scientific evidence available.

Within the physical activity environment a total of 14 reviews are cited. Most (10) of these reviews are dealing with interventions at the micro-level and far fewer (4) address the macro-level policies dealing with the natural and built environment.

Within services for families and children a total of 23 reviews are cited.:

Within the 15 reviews cited under maternal and infant services, 7 deal with how ante-natal services could support the prevention of obesity and another 7 deal with interventions to increase breastfeeding levels. An additional review describes taste development and the importance of correct intervention, at a very early age, to support a liking for healthy food, such as vegetables, throughout life.

Eight reviews are cited under preschool and school services. Preschool interventions to prevent obesity are relatively new and so only 3 reviews were found compared with 6 reviews dealing with comprehensive school interventions. Another relatively new area highlighted for intervention as part of comprehensive school policies includes the strong association between obesity and dental caries.

The EURO-PREVOB priority areas are not exhaustive such that interventions targeting the work place, older adults or interventions to improve dietary intake are not included. New evidence may reveal that the EURO-PREVOB project omitted to consider important strategies for obesity prevention. The aim of EURO-PREVOB and this review is to consider multiple health protection policies and strategies along with clear messages concerning healthy nutrition and physical activity behaviours to prevent obesity.

Table 3.1 Summary of recent reviews of interventions and policies to prevent obesity

FOOD and NUTRITION ENVIRONMENT			
EURO-PREVOB priority area	Table no. in Annex 1	Number of recent reviews cited	Policies and interventions to prevent obesity and influence on the social gradient
Food and nutrition insecurity	Table 1	Twelve reviews are cited: 9 are from 2007; 1 from 2005 (Drewnowski & Darmon ⁹); 1 from 2003 (Dowler ³) and 1 from 2000 (Nelson ²¹).	Out of the 12 reviews cited: 8 reviews discuss the association between food insecurity and obesity, but 4 reviews (Anderson 2007 ²⁴ ; Kristjansson EA et al 2007 ²⁷ ; Dowler 2003 ³ ; Nelson 2000 ²¹) do not discuss this association. Further investigations into the probable link between obesity and food and nutrition insecurity could help to identify interventions and policies that would reduce both the social gradient and the prevalence of obesity.
Front-of-pack nutrition labelling	Table 2	Five reviews cited: 2 are academic reviews from 2007; 1 academic review from 2005; and 2 NGO reports from 2005 and 2006.	There is very little research into response by obese groups or by groups with lower socioeconomic status. Overall there are very mixed results on understanding front-of-pack nutrition labels. Any benefits for low-income people may be limited because the healthier choice may be more expensive and they may be less able to use the information. For example, traffic lights do not depend on numeracy skills in the same way as GDAs do. More targeted investigations in this area would help to identify the impact of the new EU regulations on the social obesity gradient.

Promotion and marketing of foods and beverages to children	Table 3	Four reviews are cited and all were published in 2007.	In only one review (Schor & Ford 2007 ⁷¹) evidence suggests that low-income children are disproportionately at risk for both marketing exposure and becoming overweight. Reduction of exposure to marketing will be a central part of any successful anti-obesity strategy. However, there are few new regulations that restrict food marketing to young people. In addition, regulations for TV alone may lead to marketing via other means such as websites and phone.
Fiscal policies and economic tools	Table 4	Three documents are cited: 1 technical report; 1 governmental report and 1 scientific paper	No recent reviews were found following the WHO review ⁹⁵ in 2006. Unwanted side-effects, such as a decrease in fruit and vegetable intakes, may occur with taxation of unhealthy food. Therefore the impact of subsidies and taxes should be subjected to further investigation.

PHYSICAL ACTIVITY ENVIRONMENT

EURO-PREVOB priority area	Table no. in Annex 1	Number of recent reviews cited	Interventions to prevent obesity and influence on the social gradient
Physical activity policies at the macro-level	Table 5a	Four reviews are cited and all were published in 2007.	There is insufficient evidence to assess any differential effect of the interventions by socio-demographic characteristics on prevalence of obesity. However mother's education level and family income are important. It is unreasonable to expect people to be active if the environment discourages it.
Physical activity interventions at the micro-level	Table 5b	Ten reviews are cited and all were published in 2007.	Targeted interventions to prevent obesity may be preferentially taken up by better-off groups thus increasing inequalities. Multi-component interventions that included school, family and community can increase levels of physical activity. Whether the positive increases in physical activity levels, via specific interventions with individuals, are durable over the long term is unknown.

MATERNAL AND INFANT SERVICES

EURO- PREVOB priority area	Table no. in Annex 1	Number of recent reviews cited	Interventions to prevent obesity and influence on the social gradient
Maternal and infant services	Table 6	<p>Fifteen reviews are cited and all are published from 2007:</p> <p>7 papers review the evidence from interventions regarding maternal nutritional health and obesity;</p> <p>7 papers review the evidence supporting breastfeeding interventions;</p> <p>1 paper reviews the evidence to support taste and a liking for vegetables in childhood.</p>	<p>Interventions to maintain a healthy weight during and after pregnancy can be successful if: advice (healthy eating with regular, moderate physical activity) is tailored to the individual; address barriers to change; and provide ongoing support to allow for sustained lifestyle changes, especially for low-income and ethnic minorities.</p> <p>Obese, low SES mothers are less likely to initiate lactation and are prone to early cessation of breastfeeding, but appropriately designed interventions can improve breastfeeding levels in low-income mothers.</p> <p>The most important determinant of a child's liking for food, such as vegetables, is the extent to which it is familiar. Interventions, regarding early (6 months) variety exposure and the need for perseverance in the face of rejection, are successful, also within low-income families.</p>

SCHOOL SERVICES			
EURO- PREVOB priority area	Table no. in Annex 1	Number of recent reviews cited	Interventions to prevent obesity and influence on the social gradient
Preschool services	Table 7a	Three reviews are cited: 1 review from 2007; 2 reviews published in 2006; and 1 governmental report is also cited.	Child care centres offer untapped opportunities to prevent obesity. These settings help to reach children and their families. Successful interventions involve families from the earliest stages to support healthy dietary and physical activity practices both in and outside of the home. Many of these centres (e.g. Sure Start in UK or Head Start in USA) are serving low-income families.
Children and adolescent school services	Table 7b	Eight reviews are cited: 5 were published in 2007; 1 review published in 2006. Two additional reviews deal with the association between obesity and dental caries	Children from low socioeconomic backgrounds are at high risk of obesity and dental caries. Combination nutrition and physical activity interventions are effective at achieving weight reduction in school settings. School breakfast programmes for low-income children may be an effective measure in the prevention of childhood obesity. In addition, interventions that involve parents in a significant way may be particularly effective.

4. Presentation of results and discussion on policies within the food and nutrition environment

Within the food environment, increasing trade liberalisation and food subsidies have helped to distort the food supply in favour of less healthy food and more retail outlets are full of cheaper-to-produce energy-dense foods. The influence of the shift in national food distribution systems towards supermarkets and food service chains on increasing energy-density intake can be seen. Large portion sizes help to increase dietary energy intake and promotion and marketing of food and beverages aim to persuade people, particularly children, that they need these foods. The type of retail outlet accessible determines both the range and quality of foodstuffs available in addition, to the cost of food. In many European countries foods recommended in healthy eating guidelines are often more expensive than the less healthy options.

4.1. Policies and interventions to address food and nutrition insecurity

The existing gradient, across the different social groups, in obesity prevalence implies that this social obesity gradient is a population issue and not just an issue for those suffering from disadvantage and low income. This has enormous implications for the type of health protection policies and interventions needed and suggests that social welfare benefits alone will be insufficient to address the prevention of obesity. A wide spectrum of combined upstream and downstream health protection policies must be considered.

Very few evaluated interventions or policies to prevent obesity in less advantaged groups have been reported. Therefore examples of interventions designed to reduce food and nutrition insecurity may provide some evidence, and “lessons learned” for what type of interventions could be effective in preventing obesity. Thus this first section addresses what evidence exists and whether or not there is an association between food and nutrition insecurity and obesity.

4.1.1 Results concerning food and nutrition insecurity and obesity

In Annex 1, Table 1, the 12 key reviews retrieved are summarised and brief descriptions of each review are included in the table. These reviews were published between 2000 and 2008 and cover Europe as well as the USA. Few systematic reviews address food and nutrition insecurity in Europe and even fewer European investigators, with the exception of France, have suggested a strong association between obesity and food and nutrition insecurity. One recent very important European review¹ by Darmon & Drewnowski (Annex 1, Table 1) will help to raise awareness as it surveys the large body of epidemiologic data showing that diet quality does indeed follow a socioeconomic gradient. The authors also suggest possible causal mechanisms for the association.

Association between food and nutrition insecurity and obesity

A Canadian review² (Annex 1, Table 1) examined whether there is a relationship between food and nutrition insecurity and obesity. Fifteen studies were included in this review. Although the studies are inconsistent with regard to an association between food insecurity and obesity, there appears to be a trend toward a relationship. However, the authors recommend that further research is needed in Canada.

A review of food and poverty by Dowler³ (Annex 1, Table 1) makes no direct reference to the suggested evidence that the determinants of food and nutrition insecurity are similar to those of obesity. She concludes that community-based/local food initiatives (food co-operatives, cooking clubs, nutrition education) cannot address longer term changes needed in economic structures or food access (structural changes). Her critique states that food and nutrition security is perceived as an individual responsibility and not the State’s responsibility to protect health.

A study carried out in Ireland⁴ developed a healthy food basket and prices of different food items were collected and food budget standards were compiled based on various income scenarios. The percentage of household income spent on food was calculated. There was no discussion of an association between not being able to afford healthy food and having to buy cheap, energy dense/filling food, and the high levels of obesity found among less affluent groups.

A study⁵ carried out in UK, examined the characteristics of “food deserts” (food and nutrition insecurity) where the residents were: physically disadvantaged in terms of mobility and accessibility; economically disadvantaged as low-income earners; have poor nutrition/diet as they eat cheaper and more filling foods; geographically disadvantaged because of lack of choice of local food stores; and local stores provide a limited selection of foods and at high prices. Despite these determinants matching those for obesity, the author does not suggest an association.

Authors of another UK⁶ study investigated an objective evidence-based assessment of the minimum income for healthy living. The investigators recommended that this could provide operational criterion of poverty and help to set minimum income standards but no reference was made to the potential to prevent obesity in low income households.

The relationship between socioeconomic status and obesity

There are many reviews from the USA concerning the relationship between obesity and socioeconomic status^{7,8} and reviews by European investigators^{9,10} are beginning to appear in the literature. These key reviews are described in Annex 1, Table 1.

In France the social gradient in obesity increased greatly between 1992 and 2003.¹¹ This widening gap was because obesity prevalence was generally increasing in all, except the wealthiest, where the prevalence was steady or declining. Moreover for the first time in France from 2003 to 2006, there was a fall in the prevalence of obesity among the most affluent.¹² In the Lille region of France the prevalence of overweight stabilised at 5 % in the children (5 yr) of the more affluent, whereas the prevalence tripled in children from less affluent families, to reach 15% in 1999. Moreover in high school students in the Val de Marne district the prevalence of overweight was not associated with SES in 1998. However by 2005 the prevalence remained constant in the children from more affluent families, whereas it had increased twofold among the less affluent.¹³ In France generally the average obesity levels in children are stable or are decreasing, but this average trend masks the widening gap and the increasing prevalence in the most disadvantaged.¹⁴ This relationship between obesity and socioeconomic status has also been reported in studies from Nordic countries¹⁵, UK¹⁶, and Portugal.¹⁷

Causal mechanisms for observed association

Perhaps one reason why some European investigators studying food and nutrition insecurity have not considered an association with obesity is because there is an assumption that lower income groups have lower energy intakes¹⁸ and indeed some investigators show that improved intake of fruit and vegetables is not solely a matter of income.¹⁹ Motivation is also important and it appears that initiatives to increase community involvement could help improve motivation²⁰.

In one food and nutrition insecurity review, Nelson²¹ (Annex 1, Table 1) focuses on under-nutrition and not on obesity. However the policy recommendations made to prevent both under-nutrition and obesity are similar: increase income support rates; “ring fence” money for food (e.g. vouchers for food); increase child benefits; reduce taxes for the poor; use budget standards to inform tax and benefit levels; reinstate school meals for poor families; school fruit schemes; breakfast clubs at schools and nurseries; guidelines for feeding at schools; and improve physical access to healthy and affordable food.

As yet the association between nutrition insecurity and obesity has not been conclusively proven. One of the main theories put forward by Darmon & Drewnoski¹ is that it is relatively inexpensive to become obese. Fats and sugars are cheap sources of energy that satisfy the physiological drive for hunger. This encourages higher energy intakes which are reinforced by the tastiness of these energy dense foods. The finding that energy-dense foods are less expensive and also most resistant to inflation could explain why less affluent groups have higher rates of obesity.²² The higher prices for the low-energy-density foods, such as fruit and vegetables, may result in low-income people being both obese and food and nutrition insecure. Further investigation into these mechanisms could help to point to what types of interventions could prevent obesity.

Interventions to reduce food and nutrition insecurity and obesity

It has been recommended that obesity prevention programmes and policies in the USA need to address both food and nutrition insecurity and gender as key risk factors of obesity.²³ The woman's role as the family's gatekeeper²⁴ (Annex 1, table 1) of health and food security provides a possible opportunity for interventions to reduce levels of obesity within the lower socioeconomic groups. There is little published research on effective interventions undertaken with low-income women. Intervention programmes from the USA, including WISEWOMAN, the Women's Health Initiative, the American Special Supplemental Food Program for Women, Infants and Children and the Expanded Food and Nutrition Education Program provide models for changing behaviour among women, although effects of such programmes are fairly modest.

Friel and colleagues²⁵ (Annex 1, Table 1) suggest that a range of interventions are required and that it is possible to intervene at the national level in the structural determinants of healthy food, including subsidies for healthy food production: Norway successfully reversed the population shift towards high-fat, energy-dense diets by using a combination of food subsidies, price manipulation, retail regulations, clear nutrition labelling, in addition, to public education focused on individuals; and The London Development Agency plans to establish a sustainable food distribution hub to supply independent food retailers and restaurants.²⁵ One of the few evaluated examples of a multisectoral approach is Healthy Food for All²⁶ – an all Ireland multi-agency equity-oriented initiative, seeking to promote access, availability, and affordability of healthy food for low income groups. The initiative sets out to demonstrate the relationship between food poverty and other policy concerns such as health inequalities, welfare adequacy, educational disadvantage, food production and distribution, retail planning and food safety.

A Cochrane review²⁷ (Annex 1, Table 1) focused on school feeding programmes designed to provide nutritious food to food- and nutrition-insecure children and to improve their physical, mental and psychosocial health. No direct association between obesity and food and nutrition insecurity was made, but it recommended that, in high-income countries, it is important to provide “well-balanced meals that are not overly energy or fat laden” due to the problem of obesity. It was also stressed that food served should be appealing, acceptable, locally available and culturally acceptable and that school feeding programmes should increasingly aim to reduce childhood obesity.

One review from USA²⁸ (Annex 1, Table 1) proposes a conceptual framework linking the Food Stamp Program and other coping strategies to the food-insecurity–obesity relationship. This link has implications for Food Stamp Program policy changes, welfare reform, and poverty prevention. Studies from the UK²⁹ and USA³⁰ show that providing vouchers for purchasing fruit

and vegetables may offer an effective way of increasing fruit and vegetable intakes in low-income women, whereas dietary advice alone had no great effect.

Local, community-based initiatives can promote equitable access to healthy food. Community Food and Health (Scotland)³¹ supports initiatives in low-income communities which help people take up a healthy diet, and in Wales a Community Food Initiative³² also provides one-stop information and a networking resource for community staff and volunteers working in food and health. There should also be financial support through employment benefits and welfare food systems as well as support for parenting practices such as breast-feeding.³³ For example adequate paid maternity leave (for a minimum of 6 months) will help 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.³⁴

Healthy Living Centres (HLCs)³⁵ 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 socioeconomic deprivation. Paradoxically, it appears it is the most socially isolated women who are least willing to seek this professional help. A review of qualitative studies describes low-income mothers' accounts of “managing” in poverty and includes eleven studies that focus on diet, nutrition and health in poor families and values concerning “good” mothering.³⁶ The actions of women are 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 influence her behaviour. Attree suggests that official support services have the potential to support poor families, but only if services are provided in ways which are sensitive to their needs.

Within institutions it has been shown that altering the price of food can affect purchase patterns.³⁷ When the prices of low-fat items in vending machines were reduced by 10–15% the proportion of low-fat snacks purchased increased by 9–93%. Halving the price on fruits and baby carrots increased sales by a factor of 2-4. A similar finding was reported³⁸ from a restaurant where a 4-month price reduction of 20–30% on healthy food items led to higher sales showing that price reduction was more effective than health information alone.

Interventions using food aid

It has also been shown that welfare income does not cover the observed costs required to meet basic needs, suggesting that, for individuals in the poorest segments of the population, nutrition education alone will not suffice.³⁹ Based on linear programming analysis, the lowest cost required to achieve a nutritionally adequate diet in France was estimated to be €3.5/day and €3.2/day for adult men and women respectively. This is lower than the mean national expenditure for food in France (approx. €6.0/d), indicating that, for the vast majority of French adults, fulfilling the recommendations would be possible without marked increases in their food budget.

It is more difficult to achieve a healthy diet when the budget for food is just above the minimum required. The minimal cost of a healthy diet exceeds the actual budget for food of people living below the poverty level in France, e.g. those seeking food aid, whose food budget is approximately €2.3/day.⁴⁰ Since people in these groups cannot afford to consume diets that meet dietary recommendations, a food aid of good nutritional quality should be delivered to them.

However, charitable organisations face the same economic barriers, such as having to rely on food donations and having problems to transport and stock fresh foods. As a result, food aid delivered by charitable organisation is generally far from nutritional recommendations. For instance, food aid delivered by food banks in France was high in saturated fatty acids and low in dietary fibre, vitamins C and D, folate, magnesium, DHA and C18:3 ω 3.⁴¹ This study showed that there were negligible amounts of fruits, vegetables, fish, vegetable fats and unrefined staples in the food aid donations. To improve the nutritional quality of food aid interventions changes in the food collected by food banks will be required.

4.1.2 Discussion on food and nutrition insecurity and obesity

French studies were the first to show how economic constraints orient food choices towards unhealthy food choices.⁴² The cost constraints of increased energy density and decreased nutrient densities suggest that economic considerations are likely to contribute to the high prevalence of obesity and nutrient deficiencies in disadvantaged groups. This is consistent with the epidemiological observations that micronutrient intakes are more affected than macronutrients intakes by socioeconomic status.⁴³

French studies were also the first to emphasise the importance of the cost of dietary energy in explaining the link between nutritional quality and diet cost. These studies showed that the cost of dietary energy is inversely related to dietary energy density,⁴⁴ while it is positively related to the intake of essential micronutrients.⁴⁵ As shown by Drewnowski & Darmon⁹ in 2005 (Annex 1, Table 1) buying high-energy foods results from trying to buy more energy for less money, which is an advantage for poor families to satisfy their hunger, but can lead to obesity, since these foods are very palatable because of their high fat and sugar content. In contrast fruit and vegetables are the most expensive source of energy in the diet⁴⁶ and therefore may be consumed in smaller quantities by the disadvantaged. It is possible to select a nutritionally adequate diet with a low food budget but this will imply radical changes to habitual dietary practices.

A review by Burns⁴⁷ describes a strong relationship between poverty, food and nutrition insecurity and obesity and she reports that those individuals who were food-insecure had a 20–40% higher risk of becoming obese, and women were the most vulnerable. A study carried out in Finland⁴⁸ shows how the obese reported buying cheaper food due to economic problems and feared running out of money to buy food. Similarly, in the UK, Wardle⁴⁹ found that the risk of being obese was 40% higher in those receiving welfare benefits. Inequalities in the UK vary by ethnic minority groups: e.g. higher rates of obesity are found among Black African, Black Caribbean and Pakistani women.⁵⁰ Socio-economic inequalities in obesity are stronger in girls and women, and childhood circumstances lead to inequalities in adulthood obesity. Most research needs to address “upstream” influences, e.g. urbanisation and food legislation and life course and ecological studies dealing with macro-level influences.

The protection of food and nutrition security, by protecting healthy fresh wholesome foods (e.g. fruit and vegetables), against competition from less healthy commercially promoted foods is necessary as a human right and for consumer protection⁵¹. There is good evidence that structural factors such as access to food shops and availability are important along with the monetary and time cost of healthy food. The fact that such causal mechanisms are difficult to confirm through intervention studies probably explains why there have been very few reviews in the literature.

However, lack of evidence does not mean that work should be not be undertaken, and it is essential that interventions should be evaluated for their ability to engage with target groups as well as achieve the desired health outcomes.

4.2 Front-of-pack nutrition labelling

4.2.1 Results concerning front-of-pack nutrition labelling

In Annex 1, Table 2, the five key reviews retrieved are summarised and brief descriptions of each review are included in the table. These reviews were published between 2005 and 2007 and cover Europe as well as the USA.

One systematic review⁵² (Annex 1, Table 2) identified 103 papers on consumer understanding or use of nutrition labelling, most originating from North America or Northern Europe. The reported use of nutrition labels is high but more objective measures suggest that actual use of nutrition labelling during food purchase may be much lower. Available evidence suggests that consumers who do look at nutrition labels can understand some of the terms used but are confused by other types of information. Most consumers appear able to retrieve simple information and make simple calculations and comparisons between products using numerical information. However their ability to interpret the nutrition label accurately reduces as the complexity of the task increases. The reviewers concluded that improvements in nutrition labelling could make a small but important contribution towards making the existing point-of-purchase environment more conducive to the selection of healthy choices. In particular, interpretational aids (e.g. symbols and traffic lights) could help consumers assess the nutrient contribution of specific foods to the overall diet. A more recent review⁵³ that did include the impact on SES showed overall there was mixed results on understanding nutrition information on labels.

Research from the UK Food Standards Agency⁵⁴ (Annex 1, Table 2) suggests that about one third of consumers do not look at food labels at all. Participants in four European countries (UK, Netherlands, Germany and Italy) who did read labels needed significantly less time to evaluate simpler front-of-pack labelling compared to the more complex labelling format.⁵⁵ Thus simpler front-of-pack labelling formats seem more supportive to consumers in a shopping environment where quick decisions are made.

Reports^{56,57} (Annex 1, Table 2) commissioned by two large consumer agencies in Europe concluded that simplified labelling on front, such as a traffic light system, would help consumers of all backgrounds choose a healthier diet.

4.2.2 Discussion on front-of-pack nutrition labelling

Front-of-pack nutrition labelling could be an important element of a supportive environment that empowers people to make healthy food choices, assuming the cost of the healthier food is within the means of low SES groups.

Currently, under EU legislation, nutrition labelling is optional, although it becomes compulsory when a nutrition or health claim is made, or when advertising a foodstuff, or when vitamins or minerals are voluntarily added to foods. Nutrition labelling fulfils a consumer's right to information about what nutrients a food contains and could potentially be a useful tool for supporting food and nutrition security. However, as reported above, labelling must be seen in the context of the consumer's level of knowledge and ability to understand the information. The European Heart Network published in 2003 a systematic review on consumer understanding of nutrition labelling⁵⁸ and only four (out of 129) studies focused on low income populations.^{59,60} 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.

A survey in four EU countries showed that on average 56% of products included nutrition labelling.⁶¹ 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. As discussed above, research into consumers' understanding of nutrition labelling⁶² 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 (Annex 1, Table 2).

Following a consultation⁶³ in 2006 the Commission is proposing to the EU Parliament and Council that nutrition labelling is strengthened as a channel for information to consumers. The proposals require that the energy, fat, saturated fat, carbohydrates with specific reference to sugars and salt content per 100 ml/g or per portion of the product are mandatory and be displayed clearly on the front of the packet. In addition, the proportion of these elements to the reference intakes (e.g. recommended daily allowance) must be indicated. The proposal sets out reference intakes for energy and for those nutrients, which must be included on the label. These reference intake figures take into account the figures that are currently used by the industry on a voluntary basis and those that are set out in the legislation of other countries. Reference intake is a guidance daily intake for certain nutrients, which under current voluntary nutrition labelling schemes are often referred to as “recommended daily amounts”. The concept of including the percentage reference intake on food packaging is not new. It is already required under EU legislation for vitamins and minerals when listed, and many food manufacturers already include the reference amount for other nutrients on their labelling. Comparing the nutrient content of a foodstuff to a reference intake enables the consumer to better understand the relevance of the information

provided on the label for their overall diet. There is also provision for the reference intake to be reviewed at any stage if it is considered necessary.

By far the most common complaint that consumers have with regard to food labels is that they cannot find or read the information that they are looking for. Often essential information is very small, hidden or overshadowed by marketing slogans. Therefore, the draft Regulation sets out general principles for food labelling which will have to be respected by industry. These include requirements that the label is legible (print size of at least 3 mm), clear and accurate and that the presentation of voluntary information does not detract from the mandatory information.

Some innovations have been made by many companies to respond to consumer demand for more and clearer nutrition information. However, the use of nutrition labelling varies greatly from company to company and between one Member State and another, with estimates suggesting a range of between 30% and 85% for pre-packaged foods. In addition, the way that this information is displayed by companies can be widely divergent. The aim of the new EU Regulation proposed by the EU Commission is to provide a more uniform situation with regard to food labelling, so that consumers can rely on key nutritional information being presented in a consistent and easy-to-access manner. It will also create a more level playing field for industry.

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.^{64,65} 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 amount of nutrient per 100 g. Criteria for traffic light colour-coding (red = “unhealthy” and green = “healthy”) are being compared with GDA and other front-of-pack labelling schemes with a view to their widespread introduction in the UK in 2008.⁶⁶

Consumers’ understanding and responses to information on labels vary from one Member State to another. Therefore, the new European Commission proposal allows for national non-binding schemes for food labelling to be developed in addition, to the EU labelling requirements. These schemes should be based on solid consumer research and in consultation with all interested parties, and must not undermine or detract from the mandatory EU requirements for food labelling. Examples of such schemes could be nutrition symbols (e.g. traffic light schemes) or the inclusion of additional nutrition information on the front of pack. The Commission will establish and operate an exchange of information on these initiatives and will make available details of the schemes.

Producers who already display nutrition information on the front of the pack do not have to make changes to their labelling under the proposed Regulation. Many foodstuffs across the EU already carry nutrition information in wheel form or simply as a horizontal chart on the front of the pack. No uniform system for the display of the front-of-pack information is laid down in the new EU proposal, except for the order of the nutrients and the general requirements for legibility. Therefore, provided the mandatory elements are displayed clearly on the front of the pack, in line

with the requirements set out in the Commission's proposal, producers are free to decide how they wish to display the information.

Labelling may have the potential to increase the social gradient in obesity

Delivering clear and concise information about the nutritional quality for price of individual foods may help individuals who have a low budget for food to “make the right choice” by helping them to identify foods of good nutritional quality for their price.⁶⁷ However, one cannot rule out the possibility that, as an unwanted side-effect driven by the economic law of demand, disseminating this kind of information will increase the price of these foods.⁶⁸

In an international context where food prices are rapidly rising, in particular for those foods that have a low energy density, nutritional and agricultural policies should include food price regulation to ensure that the retail price of a number of foods that have a good nutritional quality and a reasonable cost of production are not submitted to disproportionate price increases due to profit margins or financial speculation. In addition, the fact that low-income people are less likely to report looking at labels raises concern that new labelling may well increase the socioeconomic gap by being more efficient among high SES individuals.

The large consumer agencies recommend that simplified labelling, specifically the traffic light system, would constitute an incentive for producers to reformulate their products. The food industry would be encouraged to lower the amount of fat, salt and sugar 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.⁶⁹ 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.⁷⁰ However, there is evidence to suggest that producers will increase the price of these reformulated products. In fact, they are already doing so: the price of high-fibre low glycaemic index cakes is higher than a regular one; as is the price of 5% fat beef burgers compared with 15% fat beef burgers. Therefore any benefits for low-income people may be limited.

4.3 Promotion and marketing

4.3.1 Results concerning promotion and marketing

In Annex 1, Table 3, the four key reviews retrieved are summarised and brief descriptions of each review are included in the table. These reviews were published during 2007 and cover Europe as well as the USA (Annex 1, Table 3).

Children's exposure to food marketing has exploded in recent years, along with rates of obesity and overweight. It appears that low-income children may be disproportionately at risk of marketing exposure and so becoming overweight⁷¹. Comprehensive reviews of the literature show that advertising is effective in changing children's food preferences and diets. Schor & Ford⁷¹ (Annex 1, Table 3) investigate the scale of food marketing practices, and especially on the growing use to “brand” food⁷² (by helping to find an identity or feeling powerful and in control) which is so potent and central to children's development and identity. The authors conclude that a

reduction of exposure to marketing will be a central part of any successful anti-obesity strategy. Another review⁷³ (Annex 1, Table 3) focused on the extent of food advertising in magazines and the internet and found that children (6–10 years) were the most frequent recipients of free confectionery. The authors suggest that proposed regulations on broadcast media may lead to more food advertising via other non-broadcast means and that consideration should also be given to restricting all food and beverage marketing techniques, such as on websites and mobile phones, aimed at children.

In response to a survey carried out in most EU countries⁷⁴, consumer groups recommended that the EU “Television Without Frontiers Directive” should ban all TV advertising of unhealthy food and beverages to children. In addition, a mechanism for pan-European monitoring of the nature and extent of food marketing to children and its regulation is needed. The author also recommends that there is a need for the adoption of a commonly agreed EU definition of an “unhealthy” food and beverages.

Despite reductions in overall levels of food advertising in Australia, children continue to experience high levels of exposure to food adverts, which remain skewed towards unhealthy foods⁷⁵. Similarly Hawkes⁷⁶ (Annex 1, Table 3) illustrates that despite the need for action, there have been few successful regulations to restrict food marketing to young people.

A novel approach is suggested by Sugarman & Sandman⁷⁷ (Annex 1, Table 3) and, indeed, they believe that there is little reason to believe that “command and control” strategies will make any difference in the USA. Instead, they propose “performance-based regulation” of the food industry. This is similar to the approach used in the “No Child Left Behind Legislation” in the USA where schools are not told how to achieve better educational results, but better outcomes are demanded of them. The authors propose that large firms selling food and drink, high in sugar or fat, will be assigned the responsibility of reducing obesity rates in a specific group of children. A firm's share of the overall responsibility will be based on its share of the “unhealthy” food market, and the children assigned to it will be organised by geographically proximate schools where obesity rates are currently above the plan's nationwide target rate of 8% (the actual childhood obesity rate is approximately 16%). Firms that fail to achieve their goals would be subject to serious financial penalties. A recent industry evaluation⁷⁸ has been carried out and aims to benchmark ten of the world's largest companies' response to obesity.

In contrast in Europe and Australia a “carrot” rather than a “stick” approach is recommended where increased exposure to fruit and vegetables TV advertisements, instead of exposure to more unhealthy foods, appear to be associated with increased fruit and vegetable consumption among European school-children.^{79,80} Unfortunately, however, obese and overweight children (9–11 yr) are more responsive to promotions which specifically stimulate the intake of energy-dense snacks⁸¹ and so regulations will still be needed.

4.3.2 Discussion on promotion and marketing

Nutrient profiles of food

In order to protect the right of consumers and protect nutritious food from unfair competition there is a need for a method to define which foods are nutritious. Nutrient profiling of foods, described as the science of ranking foods based on their nutrient content, is fast becoming the basis for defining foods⁸². This method can be used for regulating nutrition labels, health claims, and marketing to children, and for deciding which foods should be subsidised or taxed. A number of nutrient-profile models have been developed by research scientists, regulatory agencies, and by the food industry. Although nutrient-profile models are often tailored to specific goals, the development process ought to follow the same science-driven rules. These include the selection of index nutrients and reference amounts, the development of an appropriate algorithm for calculating nutrient density, and the validation of the chosen model against healthy diets.

Nutrient profile models based on protein, fibre, vitamins and minerals showed an inverse correlation with energy density that diminished as more micronutrients were introduced into the model. Models based on fat, sugar and sodium were highly correlated with energy density. Foods classified as healthier were generally associated with higher costs.⁸³ Regulatory agencies should act only when they are satisfied that the scientific process has been followed, that the algorithms are transparent, and that the profile model has been validated with respect to objective measures of a healthy diet and be strict enough to ensure consumer protection and protection of nutritious food from unfair competition.⁸⁴ A recent review⁸⁵ of nutrient profiling schemes was carried out by the Food Standards Agency in UK.

Promotion and marketing

Evidence suggests that promotion and marketing does have a significant effect on eating patterns. A review by WHO documented the evidence regarding the influence of marketing of foods and non-alcoholic beverages on children.⁸⁶ 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.⁸⁷

Very little research is focused on children in lower socioeconomic groups but some of the general findings indicate that those with lower economic status are most vulnerable to exploitation.⁸⁸ 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 socioeconomic 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.⁸⁹

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 Substitutes⁹⁰ and subsequent relevant World Health Assembly resolutions were adopted to protect women from exploitation and aggressive marketing techniques used by some commercial operators. 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.⁹¹

In UK a voluntary code of conduct was announced by the Committee of Advertising Practice in 2007.⁹² 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 regulations on broadcast adverts for food and drinks products which were drawn up by the Communications Regulator in the UK.⁹³ 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.⁹⁴ The WHO European Charter on Counteracting Obesity which stated that "*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*".⁹⁵ The issue was also addressed in the World Health Assembly in 2007, in which a resolution on noncommunicable 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...*"⁹⁶

In the EU Commission White Paper *A strategy for Europe on Nutrition, Overweight and Obesity Related Issues*⁹⁷ it is stated that "*the new Audiovisual Media Services (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*".

* Previously referred to as the "Television Without Frontiers" Directive

4.4 Fiscal policies and economic tools

4.4.1 Results concerning fiscal policies and economic tools

A technical report produced in Denmark⁹⁸ (Annex 1, Table 4) recommended that exemption of VAT on “healthy” foods and 30% increase on “unhealthy” foods would be likely to have a stronger impact on lower social classes compared with higher social classes. However, if subsidies and taxes are to be put into practice the effects should be further subjected to more in-depth investigation since taxing foodstuffs can have negative health effects if cross-elasticities of demand are ignored⁹⁹.

The Norwegian Ministry of Health and Care Services¹⁰⁰ (Annex 1, Table 4) found that a 12% drop in the price of fruit and vegetables would cause an increase in the total demand of between 4% and 15% and that in 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. Similarly, in Norway there is a tax on non-alcoholic beverages with added sugar and sweeteners, while bottled water and juice are exempt from tax with the aim of helping to reduce social gradient in obesity in the country.

4.4.2 Discussion on fiscal policies and economic tools

As discussed in the food and nutrition insecurity section above, low-income consumers are more sensitive to changes in the price food 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, stakeholders in the DG Research-funded PorGrow project¹⁰¹ 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, some believe it is not possible to define which foods are nutritious so that the “unhealthy” can be subjected to taxation and the “healthy” subsidised. However, as shown above, these criteria can be defined using nutrient profiles.¹⁰²

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. Indeed given the huge variations observed in Table 4.1 consistent VAT levels across the EU should be agreed. 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 the probable associations between low income groups, nutrition insecurity and obesity.

Table 4.1 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

Source: ATV report¹⁰⁴

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^{103,104} – 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 healthier 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 socioeconomic groups. Danish researchers recommend further analysis of the use of economic instruments in nutrition policy.

The disadvantages of this approach are more obvious in France where, on average, the costs of 100 kcal from fruit and vegetables, meat and fish, high fat-high sugar snacks, and added fats are €0.66, €0.58, €0.18 and €0.06, respectively.¹⁰⁵ The investigators suggest that to have a substantial impact on the relative prices of foods, the reduction in the price of fruit, vegetable, fish and lean meats should be 5–10 times higher than the increase in high-fat, high-sugar foods. In addition, such fat taxes are regressive: they will weight heavier on the budget of low-SES households because they are not proportional to income. A UK study by Mytton and colleagues¹⁰⁶ (Annex 1, Table 4) based on economic modelling approaches suggested that unwanted side-effects, such as a decrease in fruit and vegetable intake, may occur with taxation of “unhealthy” food.

In their strategy to reduce the social obesity gradient, the Norwegian Government¹⁰⁷ (Annex 1, Table 4) 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 is proposing the need for specific international labelling.

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 strategies¹⁰⁸; the UK Parliamentary Health Committee (2004) stated “the Government should keep an open mind on this issue ... of taxing unhealthy foods”¹⁰⁹; and the World Health Organization’s Obesity Charter (2006) states that “other important [policy] tools include fiscal and public investment policies.”⁹⁵

A WHO review¹¹⁰ 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. 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 could have a benefit on reducing the social gradient in obesity.

5. Presentation of results and discussion on policies within the physical activity environment

In Annex 1, Table 5, 13 academic reviews retrieved plus a NICE review¹¹¹ “Promoting and creating built or natural environments” are summarised and brief descriptions of each review are included in the table. These reviews were published during 2007 and cover Europe and Northern America (Annex 1, Table 5).

5.1 Upstream policies for physical activity

5.1.1 Results concerning upstream policies for physical activity

Out of the 13 reviews listed in Table 5, four address the built environment. The NICE review (Annex 1, Table 5a) included 54 studies (out of a possible 94,172) and states that there is a dearth of evidence on how environmental interventions will impact on physical activity and health inequalities and this must be taken into account when implementing the recommendations. There was also insufficient evidence to assess any differential effect of the interventions by socio-demographic or cultural factors. However, it is clear that it is unreasonable to expect people to be active when the environment discourages them. The environment is defined as “any aspect of the

physical (natural) environment or the urban or constructed (built) environment that subconsciously or consciously relates to an individual and their physical activity behaviour”.

Within the NICE guidance there is a framework and recommendations are divided into 5 environmental priorities:

- Policies and planning issues, especially urban areas;
- Transport and those responsible should reallocate road space by widening pavements and introducing cycle lanes. Restrict motor access by narrowing roads to reduce access, and introduce road user charging schemes. Introduce traffic calming schemes to restrict vehicle speed and creating safe routes to schools;
- Public open spaces and those responsible should ensure these can be reached on foot or by bicycle and are maintained to high standards;
- Buildings and those responsible for creating these should ensure staircases are positioned to encourage use;
- Schools and those responsible should ensure playgrounds are designed to encourage active play.

Recent reviews^{112,113,114} (Annex 1, Table 5) examining associations between the broader social and physical environment and physical activity levels identified factors such as safety concerns (e.g. road safety and crime), social interaction (e.g. parents, peers, neighbourhood friends), and urban design (e.g. connectivity of streets, access and availability of public open spaces and facilities) as important influences. However, much of the evidence is preliminary and future research requires better conceptualisation of the social and physical environment in which people live. Also more consideration of behaviour-specific aspects of the environment relevant to children and youth is needed. Prospective studies are needed to establish relationships between the social and physical environments where people live, work and play.

5.1.2 Discussion on upstream policies for 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.¹¹⁵ The findings from the Eurobarometer surveys 2003¹¹⁶ and 2006¹¹⁷ 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.^{118 119} 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.¹²⁰ Socioeconomically deprived neighbourhoods have few places that encourage a healthy lifestyle such as safe streets and pavements, parks, paths and community gardens.¹²¹ 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.¹²²

Walking, cycling and commuting

Because walking is a natural form of daily physical activity, it is more likely to be acceptable among “difficult to reach” sectors of the public, and both walking and cycling could make an

important future contribution to physical activity among the public if greater priority is given to planning and policy.¹²³

Traditionally most studies have only aimed to change individual behaviour. However, this approach ignores environmental determinants of physical activity and the neighbourhood environment. Positive determinants include the need for appropriate planning strategies for: urban areas; public transport; and public space. For example, public spaces have traditionally served as a meeting place, marketplace and traffic space. However, in many cities, car traffic and parking have gradually usurped public space in streets, parks and squares. This resulting situation can make it unpleasant and unsafe to walk and cycle because of noise, air pollution and risk of injury. Ways to protect, support and promote active transport, such as walking and cycling, are needed and several tools to support design and planning for active living have been developed by governments^{124, 125}.

Environmental influences, such as transport policy, are much less amenable to the traditional medical reductionist approach to evaluation and it is unlikely that they will ever be subjected to assessment by randomised controlled trials. However, if they are powerful determinants of physical activity and therefore strong drivers of the obesity epidemic, it is important that opportunities are sought to assess the impact of environmental changes that are brought about by deliberate policy interventions such as the provision of cycle paths and congestion charging schemes.¹²⁶

WHO provides other forms of evidence¹²⁷ and steps for action.¹²⁸ One approach to gathering evidence is by collecting case studies and this is the approach that is being promoted by WHO.¹²⁹ The examples emphasise collaboration between various sectors that promote physical activity, especially health and transport. It presents the results of an analysis of their approach, the type and scope of intervention, the sectors involved, their evaluation and outcomes, and indicates directions for further work. The aim is to inspire policy-makers and practitioners from the transport, health and environment sectors to work together towards the achievement of healthier and more sustainable transport.

5.2 Downstream interventions for physical activity

5.2.1 Results concerning interventions for physical activity

Out of the 13 reviews listed in Table 5, ten address downstream interventions to increase levels of physical activity (Annex 1, Table 5b). In addition, there are also two new NICE reviews, i.e. “Promoting physical activity, play and sport for preschool and school-age children in family, preschool, school and community settings” (due to be published in 2009) and “Work place health promotion: how to encourage employees to be physically active”¹³⁰. Five reviews were found relating to the effectiveness for interventions to promote physical activity in children and adolescents and five reviews for adults.

Similar to dietary interventions, physical activity promotion must start in early life and parents appear receptive to and capable of behavioural changes that may promote healthy weight in their young children.¹³¹ (Annex 1, Table 5b). The kinds and amount of physical activity young

children should do remain unclear and need further research¹³². Timmons¹³³ (Annex 1, Table 5b) summarises pertinent literature informing the nature of the physical activity required to promote healthy physical, cognitive, emotional, and social development during the early years. A particular focus is on the interaction between physical activity and motor skill acquisition. Special emphasis is also placed on the nature of physical activity that promotes healthy weight gain during early childhood. The paper also discusses the strongest determinants of physical activity in preschool-age children, including the role of the child's environment (e.g. family, childcare, and socioeconomic status) and recommendations are provided.

Regarding children and adolescents¹³⁴, multi-component interventions that include school, parents¹³⁵ and community, appear to increase levels of physical activity. However, lack of high quality evaluations hampers conclusions concerning effectiveness among children. Despite this some evidence of increased levels of physical activity was shown for interventions targeted at children from low socioeconomic backgrounds¹³⁶ (Annex 1, Table 5b). However, there were not enough studies to draw conclusions about single-parent families, family socioeconomic status and ethnicity. In a systematic review Salmon and colleagues¹³⁷ (Annex 1, Table 5b) showed that children's physical activity interventions that were most effective in the school setting included some focus on physical education, activity breaks, and family strategies. Interventions delivered in the family setting were not highly effective, but many were pilot studies. The use of motivationally tailored strategies and programme delivery in the primary care setting showed promise among adolescents. Similarly one study from the USA¹³⁸ shows that promotion of physical activity by a paediatrician appears to provide a possible mode of intervention to help reduce obesity levels, whereas another review¹³⁹ (Annex 1, Table 5b) suggested that the main factor distinguishing effective from ineffective trials was the provision of moderate to vigorous aerobic physical activity in the form of a “compulsory” rather than “voluntary” basis at school.

In adults the most successful interventions could increase walking among targeted participants by up to 30-60 minutes a week on average, at least in the short term¹⁴⁰ (Annex 1, Table 5b). Indeed, interventions to promote walking could contribute substantially towards increasing the activity levels of the most sedentary. However, there is concern that targeted interventions may be preferentially taken up by better-off groups in the population, thus increasing the social gradient in obesity levels. There is some evidence that the use of a pedometer¹⁴¹ (Annex 1, Table 5b) associated with significant increases in physical activity, also in low-income women in the USA, and significant decreases in body mass index and blood pressure. A review carried out in Canada¹⁴² (Annex 1, Table 5b) showed that nutrition and physical activity interventions aimed at low-income audiences tend to be delivered in an interactive visual format, to be culturally appropriate, to be administered in accessible primary care settings, and to provide incentives regarding participation, whereas a home-based telephone approach, although providing promising result with regard to the general population,¹⁴³ (Annex 1, Table 5b) may be less successful for low-income groups. However, whether any positive changes from these forms of interventions are durable over the long term is as yet undetermined.

Evidence-based physical activity interventions that can be delivered to large numbers of adults at an acceptable cost can be considered a public health priority. Therefore website-delivered programmes have a potential and the internet has been suggested as an effective tool to change physical activity behaviour. However, little is known about the evidence regarding such internet-based interventions. The aim of one review¹⁴⁴ (Annex 1, Table 5b) was to systematically assess

the methodological quality and the effectiveness of interventions designed to promote physical activity by means of the internet as evaluated by randomised controlled trials. Findings suggested that research is needed to identify elements that can improve behavioural outcomes, the maintenance of change and the engagement and retention of participants; larger and more representative study samples are also needed.

5.2.2 Discussion on interventions concerning physical activity

When studying the settings of the interventions it seems that comprehensive school-based interventions aiming at increasing physical activity levels through physical education and behavioural change are most likely to be effective in preventing excessive weight gain in children, whereas interventions aimed at reducing sedentary behaviour and family-based interventions seem less effective. However, most of the interventions are rather similar to “black boxes”, i.e. when they do not work it is difficult to find explanations for their ineffectiveness.¹⁴⁵

An emerging body of multidisciplinary literature documents the beneficial influence of physical activity on brain function, such as cognition and performance.¹⁴⁶ Therefore physical activity might not only help to improve a child’s physical health, but might also improve their academic performance and behaviour. Physical activity in the future may be considered an inexpensive intervention that has substantial benefits for cognitive function and brain development, in addition, to its role in preventing obesity.

The review of physical activity interventions did not identify specific successful intervention characteristics because of the heterogeneity of studies, subjects and research gaps. Substantial gaps in the literature include studies measuring effects of interventions in minority populations and economic evaluations of exercise interventions are lacking. It is clear that interventions at the micro-level must be tailored to the individual’s, especially girls, needs and parents should limit access to viewing television in the home to succeed.

To promote physical activity, planners need to design environments that support active living. Raising the profile of existing facilities may help increase physical activity especially among girls. Unfortunately, it appears that little discourse has occurred between the parks and recreation and public health professionals. Thus there is an incomplete understanding of the spectrum of missed opportunities, which highlights the need to investigate further the opportunities that exist between parks, recreation, and public health to protect, support and promote physical activity at the macro-level. At the micro-level the school arena, and particularly the after-school and preschool settings, appear to provide promising initiatives for successful interventions in the future. These are discussed further under the sections below.

6. Presentation of results and discussion on maternal, child and adolescent services

6.1 Interventions for maternal and infant health

Pregnancy provides automatic access to associated health and social services; women appear more receptive to changing their health behaviours; and pregnancy is associated with major fluctuations in body weight. There are both a “setting” and “receptive population group” amenable to appropriate health promotion intervention. In addition, these interventions can benefit not only the health of women, but also help prevent obesity within their families and the next generation.

6.1.1 Results concerning interventions for maternal and infant health

In Annex 1, Table 6, 14 academic reviews plus a NICE review “NICE guidance to improve the nutrition of pregnant and breastfeeding mothers and children in low-income households (early draft 2007)”¹⁴⁷ are summarised and brief descriptions of each review are included in the table. These reviews were published during 2007 and cover Europe and Northern America.

A review by Lavender and colleagues¹⁴⁸ (Annex 1, Table 6) investigated barriers to access to antenatal care, by considering the phenomenon of late attendance and non-attendance at antenatal classes. They identified 8 qualitative and 5 quantitative studies and failed to identify any randomised controlled trials. The participants across all qualitative studies included women from low-income backgrounds, from marginalised and minority ethnic non-English speaking communities. These women perceived the clinic offered no clear benefit and seemed to be less likely to seek care. Those who did access care considered their pregnancy a positive opportunity for change.

This review highlights the complexities associated with antenatal care services and describes how vital it is to establish standards for care. Different standards may be needed for different populations, and pursuing work with known disadvantaged groups may be a plausible option. A series of case studies of sites where the uptake of antenatal care by disadvantaged and marginalised groups is particularly high or low, may be useful to ascertain which of the elements of care are likely to maximise care-seeking behaviour; successful innovations that might be transferable; and strategies for improving care provision in sites where high-risk women are less likely to seek care.

A lack of care regarding obese pregnant women was identified in a CEMACH report¹⁴⁹ “Saving mothers lives 2003–2005” (Annex 1, Table 6) which reviews maternal deaths to make motherhood safer. The obesity prevalence figures in cross-sectional research studies in pregnant women in the UK vary from 11% to 20%. CEMACH reports that over half the women who died were overweight or obese and 35% of them (who had a recordable BMI) were obese. It was stated that pre-pregnancy counselling and weight loss, together with wider public health messages about optimum weight, should help to reduce the number of obese pregnant women.

One investigation¹⁵⁰ carried out in Sweden tried to minimise obese women's total weight gain during pregnancy to less than 7 kg and to investigate the delivery and neonatal outcome. The intervention programme was effective in controlling weight gain during pregnancy and did not affect delivery or neonatal outcome. However, a pregnant woman herself must be actively involved in setting her own goals to prevent excessive weight gain during pregnancy¹⁵¹ and she must be given continuous feedback and reinforcement over the long term. No reviews of

interventions programmes specifically aimed to prevent obesity during gestation or infancy were found¹⁵² (Annex 1, Table 6).

During the postpartum period, 14–20% of women may retain weight from pregnancy, which elevates risk of later health problems¹⁵³ (Annex 1, Table 6). A review by Schmitt and colleagues¹⁵⁴ (Annex 1, Table 6) summarised the evidence of postpartum weight retention and estimated the extent of time after delivery that weight retention is attributable to pregnancy. Although postpartum weight-loss interventions have been shown to be effective, these have been tested primarily with relatively affluent women¹⁵⁵ (Annex 1, Table 6). Continued efforts are needed in practice and research to develop effective approaches for managing weight during pregnancy and postpartum, especially for low-income women.

A WHO report examined the evidence on the long-term effects of breastfeeding through systematic reviews and meta-analyses¹⁵⁶. (Annex 1, Table 6) This report includes one chapter on breastfeeding and the risk of obesity in later life. A review by Amorim and colleagues (Annex 1, Table 6) examined the relationship between maternal overweight and obesity and breastfeeding intention and initiation and duration. The authors concluded that there is evidence from epidemiological studies that overweight and obese women are less likely to breastfeed than normal-weight women. Several reviews have been carried out to find out which interventions best support breast feeding^{157,158,159,160,161} (Annex 1, Table 6) and infant feeding practices. Obese mothers are less likely to initiate lactation and are prone to early cessation of breastfeeding¹⁶² (Annex 1, Table 6).

Providing additional professional support in prolonging exclusive breastfeeding and recommended infant feeding practices¹⁶³ should be an effective part of routine health service provision. WHO/UNICEF training courses appear to be an effective model for professional training. Joint support by professionals and lay people can be effective in prolonging any breastfeeding, especially in the first two months. One of the studies from the UK showed the greatest difference in the proportion of women still breastfeeding in lower social classes at four weeks, which was at 85% compared to only 58% in the control group. In other words the intervention had a significant impact and face-to-face support is more effective than support by telephone.

6.1.2 Discussion on interventions for maternal and infant health

Maternal

Because there are no national statistics on the prevalence of maternal obesity and only limited information regarding the provision of maternity services for obese women national programmes on obesity in pregnancy are required. This should include a survey of the provision of maternity services for obese women, development of consensus standards, information on national and regional prevalence figures and pregnancy outcomes, and an audit of clinical care. Body mass index (BMI) should be recorded for all women and an explicit plan of care developed for pregnant women who are overweight or obese.

A good example is the wide-ranging initiative 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”¹⁶⁴. A review on interventions to support breastfeeding mothers confirmed that additional professional support is needed to promote breastfeeding.¹⁶⁵ 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.¹⁶⁶

Certain paradoxes observed in low-income populations, such as not wishing to breastfeed, might be explained by the fact that low-income mothers often have low self-esteem and therefore belittle their own milk, which they regard as not as good for the child as milk substitutes, which they are told are perfectly “adapted” to the baby and the product of advanced technology. This illusion may be maintained by the high price of infant formulas, which also explains why these are abandoned in favour of cows’ milk, with associated risk of iron deficiency and future obesity. 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.¹⁶⁷

The most important determinant of a child’s liking for food, such as vegetables¹⁵⁵, is often the extent to which it is familiar. Interventions, regarding early (6 months) variety exposure and the need for perseverance in the face of rejection, are successful, also within low-income families, in encouraging infants to eat vegetables. New guidelines are required to ensure families are given the correct information by health professionals.

Initiatives such as Sure Start health development schemes¹⁶⁸ and Healthy Living Centres (HLCs)¹⁶⁹ 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 socioeconomic deprivation. Initiatives such as Sure Start Children’s 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 northern Germany. The area has a high proportion of young and single-parent families living off State benefits, who face difficulties with debt, alcohol or drug addiction and social exclusion. Guardian Angel¹⁷⁰ 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) in a way which is cost-effective and allows sustainability. Guardian Angel project has proved to be an effective prevention model for socially disadvantaged families or mothers with children aged 0–3 years¹⁷¹.

Interventions to support optimal weight during and after pregnancy

Given the increase in pregnancy weight gain in Europe¹⁷² preventing excessive gestational weight gain is important in reducing levels of obesity among women of childbearing age. There is substantial evidence that obesity in pregnancy contributes to increased morbidity and mortality for both mother and her infant. In addition, increased rates of obesity-related morbidity and mortality are reflected in increased social and financial costs: obese women spend an average of five more days in hospital and the increased levels of complications in pregnancy and interventions in labour represent a 5-fold increase in cost of antenatal care;¹⁷³ the costs associated with newborns are also increased, as in infants born to obese mothers there is a 3.5-fold increase in admission to Neonatal Intensive Care Unit; obese pregnant women appear not have the same physical endurance required to manage the combined demands of both work and pregnancy and so are less likely to be engaged in gainful employment.¹⁷⁴

There is guidance for general nutrition advice during pregnancy¹⁷⁵ but unfortunately there appears to be no guideline with regard to care in obesity in pregnancy. In the UK the CEMACH obesity project seeks to gain an overview of current service provision for obese women in pregnancy and to identify gaps that exist in the provision of care. An output of the CEMACH project will be the production of a set of recommendations for health care providers, commissioners and policy-makers on ways to improve the management of obese pregnant women and hence the outcomes for these women and their infants. Planned completion for the CEMACH project is March 2011.

As reported above, few intervention studies aimed at weight management during pregnancy have been performed.¹⁷⁶ One study¹⁷⁷ in USA 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. Similar investigations in Denmark¹⁷⁸ showed that the intervention group restricted their total weight gain during pregnancy to an average of around 7 kg compared with a gain of around 13 kg in the control group. In addition, the intervention group retained almost 7 kg less than the control group four weeks after childbirth and there were no adverse effects on the birthweights of the offspring from the intervention group.

In the Netherlands the New Life(style) study¹⁷⁹ is an individually-tailored intervention programme, which focuses on controlling weight development during pregnancy. The

effectiveness of the New Life(style) intervention programme versus usual care by midwives is being evaluated in a randomised controlled trial. 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 programme.

Another study carried out in the Netherlands¹⁸⁰ found that during pregnancy women become more aware of nutrition and seek information about healthy eating. 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. 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, education on its own is unlikely to be successful especially in groups with low socioeconomic status.¹⁸¹

It is recommended that pregnant and lactating women remain physically active in the absence of contra-indications¹⁸² because of the beneficial health effects for both mother and child.^{183,184} Recommendations have been produced by the Royal College of Obstetricians and Gynaecologists in 2006¹⁸⁵ and support the guidelines from the American College of Obstetricians and Gynaecologists.¹⁸⁶ The primary health care system should be better geared to provide guidance during pregnancy¹⁸⁷ and this should include guidance on both healthy eating and physical activity and aiming to dispel common misconceptions.

Very few weight-loss interventions for postpartum women are reported in the literature¹⁸⁸ where participants are advised both to restrict their energy intake and to increase physical activity. In one study¹⁸⁹ a mean weight loss of 0.5 kg per week over 4–14 weeks was reported. It appears that obesity has gone relatively unnoticed by maternal health services until recently. In a study in the UK¹⁹⁰ the authors recommend that overweight pregnant women should be supported to lose weight and that there is a lack of weight management guidance.

Based on the likely economic and social impacts of maternal obesity, action is needed to address weight gain before, during and after¹⁹¹ pregnancy as soon as possible. Interventions are needed to show how health professionals can better support overweight women to successfully breastfeed¹⁹² and improve infant feeding practices.¹⁹³ However, behavioural changes¹⁹⁴ and the sustainability of interventions will only be possible if the societal, cultural and living conditions are addressed along with individual counselling.

Infants

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.¹⁹⁵ Early investment in preschool 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 and good behaviour.¹⁹⁶ Investing in early years means supporting parents and ensuring all professionals responsible for preschool-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.

Interventions to improve infant feeding practices

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 investigation¹⁹⁷ was carried out. It appeared that parents did not adhere to infant-feeding guidelines and a number of cultural differences in attitudes towards infant-feeding practices were revealed.

The Global Strategy for Infant and Young Child Feeding¹⁹⁸ was endorsed by all Member States at the World Health Assembly in 2002. It aims to revitalise efforts to promote, protect and support appropriate infant and young-child feeding. The Blueprint policy document¹⁹⁹ and guidelines²⁰⁰ on "Infant and Young Child Feeding: Standard Recommendations for the European Union" assist in implementing the Global Strategy in Europe. In Scotland, the Government has developed a *Nutritional Guidance for Early Years*²⁰¹ which sits alongside *National Care Standards for Early Education and Childcare*²⁰². The relevant services will be inspected against defined standards, including healthy eating for young children. *Adventures in Foodland*²⁰³ 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 physical activity and healthy eating through a wide range of initiatives.

It is not surprising that obesity is more common in deprived populations compared with the general population. At every stage in life the determinants, known or assumed, of obesity and overweight are more frequent in disadvantaged groups. At the beginning of life the risk is higher for a newborn baby from a poor household of having an obese parent and of having a mother who smoked during pregnancy, as the prevalence of obesity and smoking addiction are higher in these populations.²⁰⁴ These infants have an increased risk of being small or large for gestational age at birth, of not having been breast-fed, and of having been fed early with cows' milk. All of these factors are thought to increase the risk of future obesity.

6.2 Interventions for preschools and school arenas

6.2.1 Results concerning interventions for preschool and school services

In Annex 1, Table 7a, four academic reviews related to preschool-children are summarised and brief descriptions of each review are included in the table. Three of these reviews were published during 2007 and one in 2006 and cover Europe and Northern Americas. In Annex 1, Table 7b, six academic reviews related to school-children and adolescents are summarised and brief descriptions of each review are included in the table. These reviews were published during 2006 and 2007 and cover Europe, Northern America and Australia. In addition, two reviews, one from 2006 and the other from 2007, report the association between dental caries, obesity and low economic status.

Preschool-children

One literature review²⁰⁵ (Annex 1, Table 7a) was found addressing preventing obesity in children aged under 5 years. This review confirms that there is a lack of evidence on effective strategies to

prevent obesity in younger children²⁰⁶ (Annex 1, Table 7a). The need remains for structured, focused and systematic research on preschool-child obesity prevention. In young children parents have a crucial role and successful interventions appear to be those that involve parents from the earliest stages of child development²⁰⁷ (Annex 1, Table 7a). A recent governmental report²⁰⁸ from the UK shows that Sure Start children's centres can effectively promote healthy eating and physical activity within the most vulnerable groups.

Children and adolescents

Six review papers^{209,210,211,212,213,214} (Annex 1, Table 7b) concerning interventions to prevent obesity in school-children (in addition, those already discussed under physical activity above) were identified. In addition, one scientific paper²¹⁵ from the Netherlands was identified because the intervention positively influenced several outcomes among adolescents from low socioeconomic backgrounds. Results suggest that it is possible to prevent obesity in children and adolescents through school-based programmes that combine promotion of healthy dietary habits and physical activity but not all studies considered the impact of interventions on low SES groups. However, a recent article²¹⁶ states that it is difficult to see how screening to identify individual school-aged children can be justified without sufficient proof of effective interventions.

In one of the review²¹⁷ (Annex 1, Table 7b) 21 interventions between 1999 and 2005 were found outside the USA. Nine targeted nutrition behaviours, followed by seven aiming to modify both physical activity and nutrition behaviours. The majority of the interventions were one academic year long and used experimental designs with at least 1-year follow-up. All interventions that documented parental involvement successfully influenced obesity indices. Most interventions focused on individual-level behaviour change approaches.

It appears that school-based multi-component interventions²¹⁸ (Annex 1, Table 7b) are effective in improving physical activity and dietary behaviour at least during the intervention. Short- and long-term school-based interventions may be effective (e.g. interventions to increase fruit and vegetable intake, improve school lunches and promote water consumption). Interventions that involve parents in a significant way may be particularly effective. Minority ethnic groups may be at greater risk of weight gain during childhood, and it appears that culturally specific interventions can improve fruit and vegetable intakes, fat intake and energy intake for up to two years. Similarly, school breakfast programmes for low-income children may be an effective measure in the prevention of childhood obesity²¹⁹ (Annex 1, Table 7b).

Dental health and obesity

Although further studies are required, evidence²²⁰ (Annex 1, Table 7b) suggests a direct association between obesity and dental caries. Dental Caries are related to poor oral hygiene and poor dietary habits (e.g. frequent consumption of refined sugars and inappropriate methods of feeding infants). People with low SES and risky lifestyle factors are among the population groups at high risk for dental caries²²¹ (Annex 1, Table 7b) and obesity.²²² Studies from Germany show that a low BMI is linked to absence of dental caries, whereas a high BMI is linked to a higher number²²³. Similarly, in France dental decay is strongly associated with a lower SES.²²⁴

6.2.2 Discussion on interventions in preschools and schools

Preschool children

A systematic review of interventions to prevent the development of obesity in preschool-children describes 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.²²⁵ 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.²²⁶ 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.

Another review of the effectiveness of interventions to promote healthy eating in preschool settings for children aged 1–5 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.²²⁷ Studies of family-based treatment for overweight 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.²²⁸ Interventions that link school and home activities appear to influence knowledge but not necessarily changes in behaviour²²⁹ and tend to be more resource-demanding than interventions conducted in schools.

Despite heightened interest in preventing obesity in childhood, the evidence base for the effectiveness of programmes and changes in policy to combat childhood obesity is poor.²³⁰ Even less research has been devoted to improving nutrition and physical activity in preschool and childcare settings²³¹ where there is lack of uniformity between programmes and fragmented oversights by regulatory authorities. Yet increasing evidence shows that preschool practices can influence the overall energy expenditure of young children.²³² Reilly and colleagues²³³ address a gap in the literature with a rigorously designed, cluster randomised controlled trial of an intervention to promote physical activity in 36 Scottish nursery schools. Body mass index and physical activity were not affected by the intervention at 6 and 12 months. These results contrast with studies showing that increasing children's physical activity can reduce weight gain²³⁴ and that changes in the quality and quantity of school physical education can increase children's activity,²³⁵ although it is not the only trial to find no benefit on body composition.²³⁶

Ultimately, the success of interventions disseminated to a variety of settings hinges on effective implementation—selection and training of staff, organisational culture and support, continuing education and technical assistance. To promote activity in youth and redress childhood obesity, parents must act to influence children's daily environments, and adults have a responsibility as decision-makers, gatekeepers, opinion leaders, service providers and role models. This will require widespread and comprehensive changes in social norms and values in nurseries, preschool settings and beyond.²³⁷

Preschool settings could be useful as part of a comprehensive strategy to prevent obesity. Preschool organisational practices and policies vary greatly and may influence young children's fitness.²³⁸ While childcare settings may have less developed infrastructures than primary and secondary schools, they also have more flexible schedules and curricula and tend to be less

bureaucratic, which may help in adaptation and dissemination of interventions. New NICE public health guidance (due January 2009) will provide recommendations on “Promoting physical activity, play and sport for preschool and school-age children in family, preschool, school and community settings”.

Children and adolescents

Failure to optimise physical and mental development when young can lead to intergenerational cycles of poverty, social exclusion and poor health outcomes.²³⁹ The school is for most children and adolescents the location where they spend most of their time when they are not at home. 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.^{240,241}

Interventions to improve food and beverage intake

School food policies 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. The WHO Regional Office for Europe,²⁴² many governments and also NGOs, such as Sustain’s Grab 5! Programme,²⁴³ 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). The UK National Heart Forum has compiled a checklist for setting up a breakfast club reported in their Food and Nutrition Poverty Toolkit.²⁴⁴ Some of the key steps include: assess parental interest; identify fund-raising needs; 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.

Although the evidence for school breakfast clubs being able to promote health dietary patterns and healthy body weight is equivocal,²⁴⁵ 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.^{246,247,248} 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.²⁴⁹

Taste and availability have been identified as the most important determinants of fruit and vegetable intake in adolescents.²⁵⁰ 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.²⁵¹ 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.²⁵² School food prices significantly affect choices, especially for children from low-income families.²⁵³ 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.²⁵⁴ In addition, the more vending machines there are in schools the lower the intake of fruit and vegetables.²⁵⁵

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.²⁵⁶ For example, in

Norway free fruits and vegetables are provided for all children in day-care centres and primary schools.²⁵⁷ 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.²⁵⁸ 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. Similarly, the UK has a free school fruit scheme which was evaluated²⁵⁹. 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 Norway²⁶⁰ finds 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 UK and Latvia. Latvia has amended a school food hygiene law and all foods and drinks with additives and too much salt are now banned from kindergartens and schools.^{261,262} It is prohibited to distribute in the educational establishments drinks with colorants, sweeteners, preservatives, caffeine and amino acids.

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.²⁶³ 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 sessions in the curriculum or by extra-curricular, supervised sessions (e.g. lunchtime exercise clubs and after school physical activity). Studies with a moderate increase (e.g. 3 x 30 min weekly) have seldom been able to increase total physical activity or decrease obesity.²⁶⁴ 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 in School-aged Children Study²⁶⁵ 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” to and from schools, a growing movement in Europe. While it appears that the general promotion of active travel may not be effective,²⁶⁶ 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.^{267,268}

Health and dental services

Health care professionals, including school health and dental services, school nurses, family health visitors and primary care professionals are in a key position to support obesity prevention in children and adolescents.^{269,270} Experience with childhood obesity screening has developed in the last two decades and some guidelines are available.^{271,272,273} 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.²⁷⁴

Though some studies find that adolescents might perceive their health care providers as a valuable source of care and information,^{275,276} adolescents may be harder to reach as they seek independence in decision-making and may fail to attend appointments.²⁷⁷ 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.²⁷⁸ 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.²⁷⁹ Free, anonymous clinics for adolescents may also meet the needs of those feeling stigma or discrimination and those unable to afford or access clinics.

As far as possible school and primary health care providers should involve parents and other key actors and focus on healthy lifestyles. 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.²⁸⁰ 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.²⁸¹ 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.^{282,283,284} Dental health programmes should also be linked to health promotion initiatives.

Comprehensive school policies

Schools are also a setting where inequities can be reinforced. For example, schools can make money through placing soft-drink vending machines on school property and by subcontracting lunch programmes, which encourage the sale of high-profit, low-quality foods, including fast food. In addition, if class sizes are large and there is lack of equipment for physical education this can present barriers to participation in sports.²⁸⁵ Effective interventions in schools are those that make healthy options available, while also restricting the availability of unhealthy foods and options for inactivity.²⁸⁶ Reviews of 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 kg over a period of a year or more compared with non-intervention controls.²⁸⁷

As discussed earlier 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. ^{288,289,290,291}). Most of the studies are American but studies were performed in Germany and in the UK. The studies, which had a significant effect on overweight were “Dance for Health”, “Planet Health”, “San Jose Study”, “Kiel Obesity Prevention Study”, “Healthy Schools” programme, “El Paso Catch”, and “Medical College of Georgia FitKid Project”. The studies differ greatly with

regard to age group, length of intervention and type and amount of actions. Half of the studies were successful and had a positive effect on either overweight or obesity.²⁹²

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, for example, 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.²⁹³ This could be a forerunner to the regulation of marketing of food and beverages to children at a European level.

Schools should be encouraged to work more closely with dental and health services in order to develop comprehensive policies to protect, support and promote food and nutrition security and access to physical activity in order to promote healthy development in children. 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.^{294,295} 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.²⁹⁶ These results were echoed in a WHO review of reviews of comprehensive school policies.²⁹⁷

7. Conclusion

This review is guided by the EURO-PREVOB priority areas (Figure 1): food and nutrition insecurity; front-of-pack labelling; promotion and marketing; fiscal policies; physical activity – policies and interventions at macro- and micro-level; maternal and infant services; and preschool and school services. Overall, a total of 50 reviews are cited for this EURO-PREVOB review, along with 2 governmental reports, 1 technical report, and 1 scientific paper.

Within the food and nutrition environment a total of 21 reviews are cited (food and nutrition insecurity (12); front-of-pack labelling (5); and promotion and marketing (4)). In addition, 1 governmental report, 1 technical report and 1 scientific paper address fiscal policies, a EURO-PREVOB priority area where there is the least published scientific evidence available. Within the physical activity environment a total of 14 reviews are cited. Most (10) of these reviews deal with interventions at the micro-level and far less (4) address the macro-level policies dealing with the natural and built environment.

Within services for families and children (life course approach) a total of 26 reviews are cited: Within the 15 reviews cited under maternal and infant services, 7 of these deal with how ante-natal services could support the prevention of obesity and another 7 deal with interventions to

increase breastfeeding levels. An additional review describes taste development and the importance of correct intervention at a very early age to ensure a sustained liking for healthy food, such as vegetables. Eight reviews are cited under preschool and school services. Preschool interventions are relatively new and so only 3 reviews are cited, compared with 6 reviews dealing with comprehensive school interventions to prevent obesity. Another relatively new priority highlighted in this review for consideration as part of comprehensive school policies includes the positive association between obesity and dental caries.

The EURO-PREVOB priority areas are not exhaustive such that interventions targeting the workplace, older adults or interventions to improve dietary intake are not included. New evidence may reveal that the EURO-PREVOB project has omitted to consider important strategies for obesity prevention. For example, a recent systematic review by Thorogood et al²⁹⁸ included a review of dietary interventions that address groups, communities or whole populations. This type of intervention is considered less resource-intensive compared with one-to-one interventions. In the review by Thorogood et al a total of 41 studies were included (only 10 from European countries). The characteristics of successful interventions included: delivery of clear messages with multiple strategies to reinforce them; some degree of intervention personalised to match individual characteristics; provision of feedback to individuals on their change of behaviour; longer duration of intervention with multiple contact with participants; provision of incentives and continuous support; simple signs identifying healthier choices, changes in food availability, point-of-purchase display policies in supermarket and catering settings. These recommendations reinforce the approach adopted by EURO-PREVOB, where the aim is to consider multiple health protection policies and strategies along with clear messages concerning healthy nutrition and physical activity behaviours to prevent obesity.

Annex 1. Summary of results and key reviews identified in the literature

Table 1. Food and nutrition insecurity with or without an association with obesity

Authors, year and reference	Title	Type of review (academic/NGO/governmental/other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Darmon, N. and Drewnowski, A. Am J Clin Nutr. 2008;87:1107-13. ¹	Does social class predict diet quality?	Systematic review	International with studies including many from Europe	Food and nutrition insecurity is associated with obesity.	The purpose of this review is to explore the possible causal relations between SES and diet quality.	The high cost of nutrient-dense foods and ease of access to low-cost energy-dense foods may be potential causal mechanism for higher prevalence of obesity in lower SEGs
Shrewsbury V and Wardle J. Obesity (Silver Spring) 2008, 16(2):275-84. ¹⁰	Socioeconomic status and adiposity in childhood: a systematic review of cross-sectional studies 1990-2005.	Systematic review	International review of 45 studies: UK(11), Germany (7), USA (7), Australia (6), Italy (4), France (2), The Netherlands (2), Belgium (1), Canada (1), Ireland (1), Spain (1), Sweden (1), Switzerland (1).	SES was inversely associated with adiposity in 19 (42%; no association in 12 (27%), and 14 (31%) there was a mixture of associations across subgroups	Research carried out within the past 15 years finds that associations between SES and adiposity in children are predominately inverse, and positive associations have all but disappeared.	Research is needed to understand the mechanisms through which parental social class influences childhood adiposity. Population strategies are needed, but targeted prevention efforts for lower SES groups may also be appropriate.

Authors, year and reference	Title	Type of review (academic/NGO/governmental/other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Ontario Public Health Research, Education and Development, 2007. ²	Is there a relationship between food insecurity and overweight/obesity?	Systematic review	Review of 15 studies – 13 from US and 2 from Canada	Food and Nutrition security – inconsistent links to obesity	The objective of this review was to determine if there was a relationship or association between food insecurity and obesity.	Although studies are inconsistent with regard to an association between food insecurity and obesity there appears a trend towards a relationship.
Drewnowski A. Epidemiol Rev. 2007;29:160-71. ⁷	The real contribution of added sugars and fats to obesity.	Systematic review	USA	Food and nutrition insecurity is associated with obesity.	Obesity has been linked repeatedly to consumption of low-cost foods.	Obesity rates in the US are a function of socioeconomic status.
McLaren L. Epidemiol Rev. 2007;29:29-48. ⁸	Socioeconomic status and obesity.	Systematic Review including 333 published studies	International: studies include countries with high, medium and low HDI.	SES was inversely associated with adiposity in countries having high HDI.	Results highlight obesity as a social phenomenon, for which action includes both economic and sociocultural factors.	Low SES associated with larger body size especially for women in developed countries.
Friel S., Chopra M., Satcher D. BMJ 2007;335:1241-1243. ²⁵	Unequal weight: equitable policy responses to the global obesity epidemic	Review	International	Food and nutrition insecurity is associated with obesity.	Focusing only on actions to make people eat more healthily and be more physically active misses the heart of the problem.	Unless the underlying unequal distribution of factors that determine obesity are addressed the obesity epidemic and its inequities will persist and possibly increase.

Authors, year and reference	Title	Type of review (academic/NGO/governmental/other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Dinour LM, Bergen D, Yeh MC. J Am Diet Assoc. 2007;107: 1952-1961. ²⁸	The food insecurity-Obesity Paradox: a review for the literature and the Role of Food Stamps May Play.	Systematic review	USA	Food and nutrition insecurity is associated with obesity.	There are implications for Food Stamp Program policy changes, welfare reform, and poverty prevention.	Proposes a conceptual framework linking the Food Stamp Program and other coping strategies to the food insecurity-obesity relationship.
Anderson AS. Proc Nutr Soc 2007;66:25-32. ²⁴	Nutrition interventions in women in low-income groups in the UK	Review	Mainly UK	Food and nutrition insecurity in women No link to obesity in lower SEGs.	Engaging women from “hard to reach” groups is a challenge and the ability of programmes to engage this group, as well as for behavioural change and health outcomes, should be evaluated.	Interventions to change diet need to take account of factors that influence household economic status
Kristjansson, EA et al, Cochrane Database of Systematic Reviews 2007, Issue 4. ²⁷	School feeding for improving the physical and psychosocial health of disadvantaged elementary school-children	Systematic review (9 out of 18 studies were in higher income countries)	International (high and low income countries) school feeding programmes for disadvantaged children.	Food and nutrition security Only indirect link to obesity in lower SEGs.	the results from school feeding programmes higher income countries are mixed but generally positive The majority of participants had to be socioeconomically disadvantaged.	School meals should be combined with other interventions to improve educational attainment and development of marginalised children.

Authors, year and reference	Title	Type of review (academic/NGO/governmental/other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Drewnowski A, Darmon N. Am J Clin Nutr 2005;82(suppl): 265S-73S. ⁹	The economics of obesity: dietary energy density and energy cost.	Systematic Review	Mainly France and USA but includes studies from UK and DK.	Food and nutrition insecurity is associated with obesity.	Raises the concern that diet costs have not been raised as a major issue with regard to obesity prevention policy	Stemming the obesity epidemic cannot be separated from stemming the tide of poverty.
Dowler, E. Development Policy Review 2003;21(5-6):569-580. ³	Food and Poverty: Insights from the “North”	Review	International, UK and Europe Food poverty, food insecurity, state, private and voluntary responses	Food and nutrition security No link to obesity in lower SEGs.	Critique that food is as an individual responsibility and not seen as a citizens’ right and state responsibility.	Community food initiatives are criticised and longer term structural/food access initiatives are recommended
Nelson, M. Proceedings of the Nutrition Society 2000;59, 307-315. ²¹	Childhood nutrition and poverty	Review	Children in Britain. Childhood poverty, food budget standards, food poverty, UK food policy options	Food and nutrition security No link to obesity in lower SEGs.	Minimum income and food budget standards used to measure (food) poverty.	Range of initiatives recommended to support those that are most vulnerable to food and nutrition security

Table 2. Front-of-pack nutrition labelling

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Grunert KG and Wills JM. J Public Health. 2007; 15:385-399. ⁵³	A review of European research on consumer response to nutrition information on food labels.	Systematic review	European	Front-of pack nutrition labelling	Research on front-of-pack consumer research reviewed from 2003 to 2006.	Overall there were mixed results on understanding nutrition information on labels.
Harper L, et al. Food Standards Agency 2007. ⁵⁴	Food Labelling Consumer Research What consumers want.	Review	UK and other European countries	Front-of pack nutrition labelling	A significant minority (about a third) claim not to look at the label at all.	None
Stockley, L European Heart Network, Brussels. 2006. ⁵⁶	Review of “front of pack” nutrition schemes.	NGO report	European Union	Front-of pack nutrition labelling	The traffic light system performed best in helping consumers make healthier choices (Food Standards Agency, 2006).	None
Cowburn G & Stockley L. Public Health Nutr 2005, 8: 21-28. ⁵²	Consumer understanding and use of nutrition labelling: a systematic review.	Systematic review	103 papers on consumer understanding or use labelling, most from USA or Europe.	Front-of pack nutrition labelling	improvements in nutrition labelling could make a small but important contribution towards selection of healthy choices.	None
Bureau Européen des Unions de Consommateurs (BEUC) 2005. ⁵⁷	Discussion Group on Simplified Labelling: Final Report	NGO report	European Union	Front-of pack nutrition labelling	Simplified labelling would constitute an incentive for producers to reformulate their products.	Simplified labelling on front plus back of pack would help consumers of all backgrounds choose a healthy diet.

Table 3. Promotion and marketing of foods and beverages to children

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Schor JB, Ford M. J Law Med Ethics. 2007;35(1):10-21. ⁷¹	From tastes great to cool: children's food marketing and the rise of the symbolic.	Review	USA	Marketing	Reduction of exposure to marketing will be a central part of any successful anti-obesity strategy.	Low-income children are disproportionately at risk for both marketing exposure and becoming overweight.
Cowburn G, Boxer A. Public Health Nutr. 2007;10(10):1024-31. ⁷³	Magazines for children and young people and the links to internet food marketing: a review of the extent and type of food advertising.	Systematic review	European	Marketing	Children (6-10 yr) are the most frequent recipients of free confectionery. Regulations on broadcast media may lead to more food advertising via other means and so marketing on websites aimed at children should be restricted.	None
Hawkes C. Am J Public Health. 2007;97(11):1962-73. ⁷⁶	Regulating and litigating in the public interest: regulating food marketing to young people worldwide: trends and policy drivers.	Review	International	Marketing	There have been few new regulations that restrict food marketing to young people.	None
Sugarman SD, Sandman N. Duke Law J. 2007;56(6):1403-90. ⁷⁷	Fighting childhood obesity through performance-based regulation of the food industry.	Review	USA	Marketing	Large firms selling food and drink that is high in sugar or fat should be assigned the responsibility of reducing obesity rates in children.	None

Table 4. Fiscal policies and economic tools

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Danish Academy of Technical Sciences, 2007 www.atv.dk . ⁹⁸	Economic nutrition policy tools: useful in the challenge to combat obesity and poor nutrition?	Technical report	DK and Europe	Economic tools	If subsidies and taxes are to be put into practice the effects should be subjected to further investigation	A model of exemption of VAT on “healthy” and 30% increase on “unhealthy” foods seems to have stronger impact on lower social classes.
Ministry of Health and Care Services, Norway 2007. ¹⁰⁰	National strategy to reduce social inequalities in health.	Governmental report	Norway	Economic tools	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 %.
Ministry of Health and Care Services, Norway 2007. ¹⁰⁷	National strategy to reduce social inequalities in health.	Governmental report	Norway	Economic tools	Tax on non-alcoholic beverages with added sugar and sweeteners, while bottled water and juice are exempt.	Aimed to help reduce social gradient in obesity
Mytton O et al. J Epidemiol Community Health 2007;61:689–694. ⁹⁹	Could targeted food taxes improve health?	Scientific paper	UK	Economic tools	A carefully targeted fat tax could produce modest but meaningful changes in food consumption and a reduction in CVD.	Unwanted side effects, such as a decrease in fruit and vegetable intakes, may occur with taxation of unhealthy food.

Table 5a. Physical activity and the built environment

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
NICE 2008. ¹¹¹	Promoting and creating built or natural environments that encourage and support physical activity	NICE review	Mostly UK	Built environment and physical activity	There is a dearth of evidence on how environmental interventions impact on physical activity and health inequalities. This must be taken into account when implementing the recommendations.	There is insufficient evidence to assess any differential effect of the interventions by socio-demographic or cultural factors.
Ferreira I et al. <i>Obes Rev</i> 2007;8(5):129-54. ¹¹²	Environmental correlates of physical activity in youth – a review and update	Systematic review including 150 studies	International	Physical activity in children and adolescents.	Parent's PA, time spent outdoors and school PA-related policies, mother's education level, family income, and non-vocational school attendance are linked to physical activity levels.	Mothers education level and family income mentioned as an important factor
Wendel-Vos W et al. <i>Obes Rev</i> 2007; (5):425-40. ¹¹³	Potential environmental determinants of physical activity in adults: a systematic review	Systematic review including 47 studies	International	Physical activity in adults	Social support and having a companion for physical activity were convincingly associated with physical activity.	No conclusions can be drawn and more research is needed. Availability & access to facilities are important.
Papas MA et al. <i>Epidemiol Rev</i> 2007;29:129-43. ¹¹⁴	The built environment and obesity	Systematic review including 20 studies	International	Access to physical activity by general population	Given the limited success of individual-based interventions more research on the impact of the built environment is needed.	none

Table 5b. Downstream interventions for physical activity

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
van Sluijs EM, et al BMJ. 2007;335(7622):703-707. ¹³⁶	Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials.	Systematic review including 57 studies: 33 aimed at children and 24 at adolescents.	International	Physical activity in children and adolescents.	For adolescents, multi-component interventions that included school and family/ community can increase levels of physical activity. Lack of evaluation hampers conclusions concerning effectiveness.	Some evidence of effect was shown for interventions targeted at children from low socioeconomic backgrounds.
Salmon J et al. Epidemiol Rev 2007;29:144-59. ¹³⁷	Promoting physical activity participation among children and adolescents.	Systematic review including 76 interventions (57 via school, 9 family, 6 primary care and 4 community or internet-based).	International	Physical activity in children and adolescents (4-19 yr)	Most effective school interventions were those that included some focus on physical education, activity breaks, and family strategies. Further evidence of the effectiveness is needed.	None
Connelly JB et al. Public Health 2007;121(7):510-7. ¹³⁹	A systematic review of controlled trials of interventions to prevent childhood obesity and overweight: a realistic synthesis of the evidence.	Systematic review of 28 studies	International	Physical activity in children	The main factor distinguishing effective from ineffective trials was the provision of moderate to vigorous aerobic physical activity in the form of a “compulsory” rather than “voluntary” basis.	None

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Campbell KJ and Hesketh KD Obes Rev 2007;(4):327-38. ¹³¹	Strategies which aim to positively impact on weight, physical activity, diet and sedentary behaviours in children (0-5 yr).	Systematic review of the literature including 9 studies	Mostly USA	physical activity in preschool-children	Parents are receptive to and capable of some behavioural changes that may promote healthy weight in their young children.	None
Timmons BW et al. Can J Public Health 2007, 98 S2:S122-34. ¹³³	Physical activity for preschool-children--how much and how?	Systematic review	Canadian	Physical activity in preschool-children	Describes the nature of physical activity that promotes healthy weight gain during in early childhood	Determinants of physical activity in preschool-children includes the child's environment (e.g., family, child-care, and SES).
Ogilvie D et al. BMJ 2007;334(7605):1204-7. ¹⁴⁰	Interventions to promote walking: systematic review	Systematic review	International	Physical activity in adults	Interventions can increase walking by up to 30-60 minutes a week on average, at least in the short term in a targeted group.	Targeted interventions may be preferentially taken-up by better off groups thus increasing inequalities.
Bravata DM et al. JAMA 2007;298(19):296-304. ¹⁴¹	Using pedometers to increase physical activity and improve health: a systematic review	Systematic review of 26 studies.	International	Physical activity in adults	Use of pedometers appear to increase physical activity and decrease BMI and blood pressure. Whether these changes are durable over the long term is undetermined.	None

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Chaudhary N, Kreiger N. J Diet Pract Res. 2007;68(4):201-6. ¹⁴²	Nutrition and physical activity interventions for low-income populations	Systematic review	International from Canada	Physical activity and nutrition interventions in adults	Interventions delivered in an inter-active visual format; culturally appropriate; provided in accessible primary care settings; provide incentives.	Interventions are designed specifically for low-income populations
Eakin EG et al. Am J Prev Med. 2007;32(5):419-34. ¹⁴³	Telephone interventions for physical activity and dietary behaviour change: a systematic review	Systematic review	International from Australia	Physical activity and nutrition interventions in adults	Evidence supports the efficacy interventions in which the telephone is the primary intervention method.	None
van den Berg MH et al. J Med Internet Res. 2007; 30;9(3):e26. ¹⁴⁴	Internet-based physical activity interventions: a systematic review of the literature	Systematic review 10 eligible studies and 5 met criteria.	International.	Physical activity	The effectiveness of internet-based physical activity interventions such as increased supervisor contact, tailored information, remains to be established.	None

Table 6. Maternal and infant services

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Hannula L, Kaunonen M, Tarkka MT. J Clin Nurs. 2008;17:1132-43. ¹⁶⁰	A systematic review of professional support interventions for breastfeeding.	A systematic review was carried out by a team of researchers in Helsinki with the aim of assessing the effectiveness of a variety of interventions in supporting breastfeeding.	The literature search was limited to articles published in Finnish, Swedish and English between the year 2000 and March 2006.	Breastfeeding	Interventions during and after pregnancy were more effective than short interventions. Interventions using various methods of education and support from well-trained professionals are most effective. BFHI provides an effective approach. Postnatally home visits, telephone support and breastfeeding “centres” combined with peer support were effective. Professionals need breastfeeding education.	None
Hoddinott P, Tappin D, Wright C. BMJ 2008;336:881-887. ¹⁶¹	Clinical review. Breastfeeding .	Systematic review	UK	Breastfeeding	This review is aimed at primary health care staff and concerns management practices. It provides a useful resource for those staff charged with the training of medical staff.	None

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
UK (England) – (early draft 2007). ¹⁴⁷	Draft guidance to improve the nutrition of pregnant and breastfeeding mothers and children in low-income households	NICE guidance	UK	Maternal nutritional health and obesity	Women encouraged to reduce BMI (< 30) before and after pregnancy. Advice (healthy eating with regular, moderate PA) should be tailored to the individual or group; address barriers to change; and provide ongoing support to allow for sustained lifestyle changes.	NICE guidance to improve the nutrition of pregnant and breastfeeding mothers and children in low-income households
Schmitt NM et al. Int J Obes 2007;31(11):1642-51. ¹⁵⁴	The association of pregnancy and the development of obesity - results of a systematic review and meta-analysis on the natural history of postpartum weight retention.	Systematic review and meta-analysis of qualitatively homogeneous studies	International	Maternal nutritional health and obesity	Summarised evidence of postpartum weight retention and estimated the extent of time after delivery that weight retention is attributable to pregnancy.	None
Lavender et al. www.cemach.org.uk 2007. ¹⁴⁸	Access to antenatal care: a systematic review	Systematic review of 5 quantitative and 9 qualitative studies	International (France, Ireland, UK, Canada and USA)	Maternal nutritional health and obesity	Prospective, studies are required in each country to address the issues of standards for ante-natal care.	Studies of sites where the uptake of antenatal care by disadvantaged groups is high or low, may ascertain which elements of care can maximise care-seeking.

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Confidential Enquiry into Maternal and Child Health (CEMACH) London 2007. ¹⁴⁹	Saving Mothers lives – reviewing maternal deaths to make motherhood safer 2003-2005	Expert report	UK	Maternal nutritional health and obesity	Pre-pregnancy counselling and weight loss, together with wider public health messages about optimum weight should help to reduce the number of obese women who become pregnant.	Many obese pregnant women had chaotic lifestyles and found it hard to engage with maternity services.
Conroy S et al. Obes Rev 2007;8(1):61-7. ¹⁵²	An integrative review of Canadian childhood obesity prevention programmes	Review	Canada	Maternal nutritional health and obesity	No intervention programmes specifically aimed to prevent childhood obesity during gestation or infancy	None
Walker LO. J Obstet Gynecol Neonatal Nurs. 2007;36(5):490-500. ¹⁵³	Managing excessive weight gain during pregnancy and the postpartum period.	Systematic review	USA	Maternal nutritional health and obesity	Postpartum weight loss interventions have been shown to have efficacy.	Continued efforts are needed to develop effective approaches for managing weight during pregnancy and postpartum, especially for low-income and ethnic minorities.
Amorim AR et al. Cochrane Database Syst Rev. 2007;(3):CD005627. ¹⁵⁵	Diet or exercise, or both, for weight reduction in women after childbirth.	Systematic review including 6 studies.	USA and Australia	Maternal nutritional health and obesity	Dieting and exercise together appear to be more effective than diet alone at helping women to lose weight after childbirth	Not clear if diet plus exercise is an effective strategy in low-income women.

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
WHO 2007. ¹⁵⁶	Evidence on the long-term effects of breastfeeding: Systematic reviews and meta-analyses.	Systematic review and WHO report	International	Breastfeeding	Includes one chapter on breastfeeding and the risk of obesity in later life, and includes an update of existing meta-analyses.	Longer durations of breastfeeding for wealthier and more educated mothers.
Amir LH, Donath S. BMC Pregnancy Childbirth. 2007;7:9-12. ¹⁶²	A systematic review of maternal obesity and breastfeeding intention, initiation and duration.	Systematic review including 15 studies	International (USA, Australia, Denmark, Kuwait, Russia)	Breastfeeding	Overweight and obese women are less likely to breastfeed than normal weight women	Young mothers and low-income women are less likely to breastfeed.
Britton C et al. Cochrane Database of Systematic Reviews, 2007. Issue 1. Art.No.: CD001141. ¹⁶⁵	Support for breastfeeding mothers (review)	Systematic review	International 14 developed countries including UK, Germany and Scandinavian countries	Breastfeeding	Providing additional professional support in prolonging exclusive breastfeeding is effective as part of routine health service provision.	Two studies targeted low-income women, who are least likely to start breastfeeding or continue for a sufficient period of time.
Jevitt C et al. J Midwifery Women's Health 2007;52(6):606-613. ¹⁵⁸	Lactation complicated by overweight and obesity: supporting the mother and newborn	Systematic review	Australia, USA, and others	Breastfeeding	Obese mothers are less likely to initiate lactation and are prone to early cessation of breastfeeding. Energy restriction paired with exercise for postpartum weight loss does not affect milk quality or infant growth.	None

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Renfrew MJ et al. Public Health Nutr 2007;10(7): 726-732. ¹⁵⁹	Rethinking research in breastfeeding: a critique of the evidence base identified in a systematic review of interventions to promote and support breastfeeding	Systematic review	UK (wide international search)	Breastfeeding	The reasons for low breastfeeding rates are multifaceted, including the culture of early return to work among low-income women.	Low initiation rates among disadvantaged families add to social inequalities in health outcomes.
Cooke L. J Hum Nutr Diet 2007 20;294-301. ¹⁶³	The importance of exposure for healthy eating in childhood: a review	Review	France, USA, Germany, UK, and other countries	Taste development and vegetable and fruit intake.	The most important determinant of a child's liking for a particular food is the extent to which it is familiar. Techniques of exposure and the need for perseverance in the face of initial rejection is stressed.	Low-income mothers and their 2-year-old children attending a Sure Start children's centre in one of the 10% most deprived areas in the UK.

Table 7a. Preschool-children

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Ofsted 2008 http://www.ofsted.gov.uk/assets/Internet_Content/Shared_Content/Files/2008/jan/childcentres_exchs.doc . ²⁰⁸	How well are they doing? The impact on children's centres and extended schools	Governmental report - evaluation of Sure Start children's centres.	UK	Young children in preschool settings	All 30 children's centres surveyed promoted healthy eating and physical activity very effectively.	Sure Start Children's centres are aimed at helping the most vulnerable groups.
Saunders KL. J Public Health 2007;29(4):368-375. ²⁰⁵	Preventing obesity in preschool-children: a literature review	Review	International	Young children in preschool settings	Young child feeding, physical activity and family-based interventions in preschool arena can be successful. However well-designed studies examining a range of interventions in preschool settings remain a priority.	None
Story M et al. Future Child 2006;16(1):143-168. ²⁰⁶	The Role of Child Care Settings in Obesity prevention	Review	U.S.	Young children in preschool settings	Child care centers offer opportunities to form and support healthy eating habits and physical activity patterns in children. These settings offer untapped opportunities for evaluating effective obesity-prevention strategies to reach children and their families.	Head Start, a federal preschool program serving low-income children (>5yr) is a model for child care programs as it has performance standards for nutrition.

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Lindsay et al. Future Child 2006;16(1):169-186. ²²⁰	The Role of Parents in Preventing Childhood Obesity	Review	USA	Young children in preschool settings.	Successful interventions involve parents from the earliest stages to support healthy practices both in and outside of the home.	None

Table 7b. Children and adolescents

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Howerton MW et al. J Nutr Educ Behav 2007;39(4):186-196. ²⁰⁹	School-based Nutrition Programs Produced a Moderate Increase in Fruit & Veg. Consumption: meta & pooling analyses from 7 studies	Systematic review	USA	Comprehensive school policies.	School-based nutrition interventions produced a moderate increase in fruit and vegetable intake among children.	None
Sharma M. Obes Rev. 2007;8(2):155-167. ²¹⁰	International school-based interventions for preventing obesity in children	Systematic review	International (excluding U.S.) 21 interventions found Australia, Austria, Canada, France, Germany (3), Greece, NZ, Norway, Singapore and UK (9)	Comprehensive school policies. From preschool to high school, with majority (17) from elementary schools.	All interventions that documented parental involvement successfully influenced obesity indices.	None
Lissau I. Acta Paediatr Suppl. 2007;96(454):12-8. ²¹¹	Prevention of overweight in the school arena	Systematic review	International	Comprehensive school policies.	Half the studies had a positive effect on either overweight or obesity.	None

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Katz DL et al. Int J Obes 2007(Epub).doi:10.1038/sj.ijo.0803684). ²¹²	Strategies for the prevention and control of obesity in the school setting: systematic review and meta-analysis	Systematic review	International	Comprehensive school policies.	Combination nutrition and physical activity interventions are effective at achieving weight reduction in school settings.	None
Brown T et al. Obesity reviews 2007;8(s1): 127-130. ²¹³	Prevention of obesity: a review of interventions	Systematic review	International	Comprehensive school policies.	Interventions that involve parents in a significant way may be particularly effective	Effectiveness of interventions, including tailored physical activity, among low-income/ vulnerable groups remain unclear.
Selwitz RH et al. Lancet 2007, 369:51-59. ²²¹	Dental caries	Systematic review	International	Comprehensive school policies.	Caries are related to poor oral hygiene and poor dietary habits e.g. frequent consumption of refined CHO and inappropriate methods of feeding infants.	People with low SES and risky lifestyle factors are among other population groups at high risk for dental caries.
O'Dea JA et al. Health Educ Res 2006;21(6):796-805. ²¹⁴	Socio-cognitive and nutritional factors associated with body mass index in children and adolescents: possibilities for childhood obesity prevention	Systematic review	Australia	Comprehensive school policies.	School breakfast programmes for low-income children may be an effective measure in the prevention of childhood obesity	Low SES was found to contribute to high BMI and mediated by the low nutritional quality of breakfast.

Authors, year and reference	Title	Type of review (academic/ NGO/ governmental/ other)	Population covered (international, national)	Main areas covered, according to the conceptual framework	Comments	Recommendations specific to SEGs
Kantovitz KR et al. Oral Health Prev Dent 2006; 4(2):137-144). ²⁰⁷	Obesity and dental caries--A systematic review.	Systematic review	International	Comprehensive school policies.	Evidence suggests a direct association between obesity and dental caries. Further well-designed randomised studies are needed to confirm this.	None

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