

Policy Interventions to Tackle the Obesogenic Environment

Focusing on adults of working age in Scotland



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A report for the Early to Mid-Working Life Working Group of the Scottish Collaboration for Public Health Research and Policy (SCPHRP)

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Focusing on adults of working age in Scotland**

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Executive Summary

I. Introduction

Obesity has been confirmed as one of Scotland's most serious public health problems and levels have been rising steadily over the last 10 years, with marked increases in men aged 35–64 years and in women aged 35–44 years. When increasing population obesity is viewed simply as a distorted energy balance (towards excess), the solutions, namely to reduce energy intake and increase expenditure, would appear to be self evident. Drivers towards incremental weight gain however, are now closely associated with almost every aspect of modern living and the scale and complexity of the challenges involved should not be underestimated. This report presents a broad overview of the published literature on obesity prevention in adults, in a format that should help facilitate discussion about what are likely to be the most effective policy options across the four domains of the policy environment in its broadest sense, these being: physical, economic, legislative and sociocultural. In accordance with Swinburn and Eggers' ANGELO (analysis grid for environments linked to obesity) framework, the evidence in each of these domains is considered at the macro-level (i.e. national/regional) and micro-levels (local/community/institution/household). The other significant distinction to be drawn in any discussion around potential solutions to the obesity epidemic is the relative importance given to energy intake versus energy output or more specifically, diet versus physical activity. Since any serious attempt to address the problem at a societal level needs to pay attention to both these aspects, both nutrition and activity interventions have been reviewed for each of the four ANGELO domains. A growing consensus that the recent rapid population rises in obesity can largely be explained by increased energy intake, also highlights the importance of giving equivalent or greater attention to nutritional factors when deciding on how best to tackle the epidemic.

II. Physical environment

The greater availability of fast food outlets in socially deprived and in African-American neighbourhoods in the US (where much of the relevant research has been conducted), has been associated with an increased likelihood of obesity in these populations. This finding does not apply to the same extent in relatively deprived areas/predominantly ethnic minority localities of UK towns and cities. Additionally, physical proximity to affordable food choices does not appear to be a strong determinant of a healthy diet in UK settings where this has been examined. An improving international and UK research literature in this area however clearly does demonstrate a role for local environmental determinants, mainly around access to amenities and the extent of neighbourhood disorder. Also at the local level, the clearest associations for excess energy intake in commercial catering outlets including restaurants, has been for larger portion sizes and energy dense foods.

Workplace environmental interventions, including nutrition availability and information, have been robustly demonstrated to result in significant mean reductions in body mass index (BMI) and body weight for targeted groups of workers across a wide range of employment sectors. Perhaps unsurprisingly, and in keeping with ecological models, multi-component and more intensively structured interventions are associated with the best outcomes, although separating out the contributions of various programme components can be problematic. Low intensity environmental interventions by themselves (such as nutrition signs), have limited benefits within workplace settings.

Consistent associations have now been demonstrated in a number of countries between features of the external built environment and the likelihood of undertaking regular physical activity, as well as the relative prevalence of obesity and overweight. Since the majority of this work is based on US and Australian studies, there are legitimate concerns about the transferability of these findings to a UK/Scottish context. The evidence base on built environment factors is also characterised by increasingly sophisticated methods of enquiry including natural experiments, longitudinal measures and stratification by dominant preferences and behaviours, all of which point towards a degree of promise for built-environment interventions, in facilitating positive behaviour change.

There is limited UK evidence that environmental surroundings can influence active travel, but this is not particularly surprising given that baseline levels of active travel in the UK are low and largely confined to self-selected population sub-groups. International comparisons however, with countries that have equally high levels of car ownership and similar climates (e.g. Germany and Holland), gives some grounds for optimism that active travel could be promoted by built environment modifications. In this context, early results from the evaluations of six “cycling demonstration towns” in England, which have seen substantial increases in cycling as a means of travel, are also greatly encouraging. Additionally, the finding that much of the existing published evidence relates to the capacity of built environment interventions to improve safety, should not be discouraging to policy makers, in view of the clear importance of improved safety in encouraging wider participation in active travel.

Simple motivational signs can be an effective means of promoting physical activity in public settings such as shops and public transport hubs, although long term sustainability of the desired behaviour change has yet to be demonstrated. Structural interventions such as engineered ‘stair-skip’ features in buildings can also increase stair use and the initial employee/public resistance to these interventions appears to decline over time. The potential impact of such very marginal increases in energy use on population weight however, are of course only likely to be small and these kind of measures are best used as just one part of a more comprehensive multi-component strategy (e.g. at the workplace or community level).

III. *Economic environment*

Evidence from a wide variety of studies has shown that there are strong associations between population level weight gain and the consumption of energy dense food and drink. Soft drinks in particular have a relatively high ‘price elasticity’, in that their purchase by consumers, particularly those at risk from obesity and the more economically disadvantaged, is highly price sensitive compared to other types of food. A discretionary tax on soft drinks would also be a means for government to address a ‘market failure’ (in so far as the risks are currently poorly understood by consumers) and also potentially reap significant public health benefits.

At the individual level, although financial incentive schemes have been successfully employed in other areas, particularly in smoking cessation, their adoption is relatively recent in obesity prevention and weight maintenance. As with other incentive based interventions, long term behaviour change remains elusive. Recently published work carried out in New Zealand supermarkets was able to demonstrate increased fruit and vegetable purchasing in response to modest price discounts, although there were no overall changes in ‘key indicator nutrients’ like saturated fat.

IV. *Legislative environment*

Growing recognition by governments of the true scale of the obesity threat has led some commentators to draw parallels between obesity and communicable disease in that there may now be a case for statutory intervention to protect public health. Legislative interventions could involve anything from straightforward restrictions on supply, through to fiscal measures as well as obligations to provide more comprehensive information about risks. Traffic-light labelling schemes, such as that developed by the Food Standards Agency and advocated by the Faculty of Public Health, are the most effective means of conveying nutritional information to consumers. Modern developed economies with saturated food markets are currently faced with ‘increased over-consumption’ as the only means by which food manufacturers can grow their business. Dominant agricultural policies, geared towards over production for times of scarcity, are also no longer appropriate in a world of plenty, and need to be recognised as a fundamental driver of the obesity problem. On the physical activity front, transport policies and urban planning arrangements represent likely key components of any legislative approach to increase both active travel and leisure participation.

V. Sociocultural environment

Mass media is perhaps the most universal reflector and participant shaper of sociocultural attitudes in modern society. The effectiveness of media campaigns themselves however to encourage healthy behaviours is modest at best, although they still have the potential to bring about marginal population health gain at the national or regional level. Large scale public participation events are an effective means of beginning to change population attitudes and behaviours, as well as influencing individual perceptions of ability. Individually focused activity incentives (such as primary care based exercise referral), have a very mixed evidence base and their effectiveness and wider use is likely to depend on the development of improved targeting alongside better evaluation. Personal travel planning, on the other hand (at household level), has been associated with consistent reductions in car dependent travel, although there are significant concerns about the quality of the evidence. The impact of any further investment in such schemes needs to be robustly evaluated. Workplace based travel plans have also been shown to be a cost effective and feasible means of increasing more active forms of commuting in a UK setting.

The vast majority of media communication on nutrition is aimed at children, although television viewing in general is linked to obesity in a number of ways. UK broadcast regulator restrictions on junk food advertising introduced in 2006, have certainly been effective in reducing exposure during children's television hours, but there has undoubtedly been some migration of these types of adverts to family viewing times. Multi-component nutrition interventions have also had some success in changing workplace and institutional food cultures. The ambitious high profile media publicised behaviour change campaign in England, Change4Life, is aimed principally at families and has evaluated well to date on awareness raising outcomes. Ongoing evaluation is intended to look for evidence of any benefit in direct outcomes such as population healthy weight maintenance.

VI. Overall approach to available evidence

Since obesity prevention and control is such a rapidly evolving field of enquiry, many intervention proposals are currently based only on studies of association, although increasingly sophisticated quasi-experimental work is now being used to refine the evidence base around what might work through deliberate designed interventions. By necessity therefore, this rapid review of the published literature, draws upon a wide variety of study formats, depending on the extent of current progress in each particular area. Several commentators have also highlighted the need for researchers not to be restricted by conventional models of disease prevention, where causation needs to be firmly established before potential interventions are tried and tested. The one certainty is that obesity remains a highly complex multifaceted problem, closely entwined with many aspects of modern living. Unravelling the components that are most amenable to intervention will require a solution orientated approach and a readiness to consider unconventional multi-component strategies, with all the additional challenges that this represents for robust monitoring and evaluation.

VII. Development of policy options

The following document presents a relatively selective summary of the evidence available in each of the above areas and draws on a wide range of published sources including systematic reviews where these were available. It is intended to facilitate discussions among local decision makers and stakeholders about what might be the most practicable and realistic environmental and policy interventions that would have the greatest chance of success in Scotland. Chapter 7 presents an overview of the current policy landscape in Scotland, while chapter 8 presents the review findings in a summary table format and describes a structured discussion method for refining potential proposals towards implementation.

1

Chapter 1 – Introduction and overview

1.1 Background

The Scottish Collaboration for Public Health Research and Policy (SCPHRP) was set up to specifically identify the best evidence available for policy interventions to address Scotland's major public health priorities. SCPHRP's core mandate is to:

- Identify key areas of opportunity for developing novel public health interventions that equitably address major health problems in Scotland, and move those forward
- Foster collaboration between government, researchers and the public health community in Scotland to develop a national programme of intervention development, large-scale implementation and robust evaluation
- Build capacity within the public health community for collaborative research of the highest quality, with maximum impact on Scottish policies, programmes and practice.

Specifically, the Collaboration sees its own role very much as 'brokers' between public health decision makers and researchers, who otherwise do not regularly interact in Scotland (or elsewhere.) The Collaboration's overriding objective is to build relationships across this divide so that new public health programs and policies are properly thought out and pilot tested, before full implementation, and then robustly evaluated for their effectiveness and costs as a part of full roll out. SCPHRP has five years of Medical Research Council (MRC)/ the Chief Scientist Office (CSO) funding to demonstrate that such a 'collaborative' approach can achieve these goals.

1.2 Conclusions of first meeting: Workstreams

The inaugural workshops of the Collaboration in early 2009 identified four major workstreams that would constitute a life-course approach to tackling public health problems in Scotland according to key life stages:

- **Early life** - Preconception through the pre- and peri-natal periods, to the primary school years, when strong predictors of lifelong health take root, but are exceptionally amenable to change
- **Teenage and early adulthood** - When culturally influenced external causes of ill health predominate, and are currently tipping the balance towards greater health inequalities in Scotland (i.e. violence, suicide and related mental health problems; smoking, drug and alcohol abuse; and risky sexual behaviours)
- **Early to mid-working life** - When career success, work related-disability and family functioning, and consequently mental health and social issues, figure strongly as key outcomes for healthy and productive adults, but a range of chronic disease risk factors also tend to become firmly established, including the current pandemic of overweight, with all of its attendant health consequences
- **Later life** - Especially the period between ages 45 and 65, when symptomatic chronic diseases and associated disability begin to appear, typically in unequal ways across socioeconomic strata, leading to quite differential experiences of senescence.

Each dedicated work group then decided on what the priority targets for intervention should be. For the Early to Mid-Working Life group there was extensive discussion around whether to focus at the whole population level or whether a 'settings based' approach through workplace interventions would be more practicable, given the time and resource constraints involved. The group decided to include both levels of intervention, the topics prioritised being:

- Interventions to tackle obesogenic aspects of the adult environment
- Interventions to reduce sickness/injury absence and improve health in the workforce.

The current overview deals with the first of these, namely: 'obesogenic aspects of the environment' and identifying potential policies or interventions which might be effective in tackling them in a Scottish context.

1.3 Search strategy and initial guidance

The broad all-encompassing question for the initial search was: 'Are there any proven or evaluated policy interventions, or modifications to the built environment, which can promote physical activity or active travel (e.g. walking and cycling); reduce consumption of unhealthy (energy dense) diets which are high in fat and sugar or promote consumption of healthier/less energy dense foods such as increased fruit and vegetables?'

An initial scoping search was conducted using the following MeSH terms in PubMed:

Terms (('Environment Design' [Mesh] OR ('Nutritional Sciences' [Mesh] OR 'Nutrition Policy' [Mesh]) AND 'Obesity/prevention and control' [Mesh]) OR 'Overweight/prevention and control'[Mesh])

Limits Humans, Editorial, Practice Guideline, Review, English, Adult (19–44 years), Middle Aged (45–64 years). This initial search identified 144 articles in total, 116 of which were reviews.

The complexity and broad nature of influences on obesity from the surrounding environment calls for a much wider perspective than would normally be covered by traditional medico-health publication databases. For the full search a more comprehensive list of fully exploded terms (see Appendix E¹) was performed in each of the following databases (which were identified from reviews conducted by the WHO International Obesity Task Force [1] and the National Institute for Clinical Excellence in the UK (physical activity focus).

Databases

MEDLINE	Sociological abstracts
EMBASE	Planex*
CINAHL	ICONDA*
PSYCHINFO	Environline*

Campbell Collaboration

*More recently developed databases (unlikely to have many articles of interest before 2000).

Inclusion

- English only
- Human
- Adult working life 19 to 64 years inclusive[#]
- Prevention interventions can be: community, societal, infrastructural (e.g. built environment) or legislative (national or local government policy)
- Study types: reviews; (cluster) randomised trials; quasi-experimental studies; observational and cross-sectional studies (including longitudinal cohort and follow-up studies)
- Time window: 1990 onwards until September 2010 (end)

[#] Note: For PubMed searches the age categories were restricted to adult (19–44 years) and middle aged (45–64 years).

¹ Appendix E1 – available electronically through web-link: <http://www.scphrp.ac.uk>

Exclusions

- Individual based (e.g. clinical/therapeutic) interventions for obese or overweight patients
- Rehabilitation programs or measures after injury or medical procedures
- Nutrition measures/interventions for individuals or groups with eating disorders or other serious underlying illness.

This search strategy identified a total of 78 review level articles and 49 primary studies. Reference lists and forward citation tracking through Web of Science identified a further 34 intervention specific reports. The remaining reference sources were editorials, policy frameworks and electronically accessed grey literature. All reviews which materially contributed to this report will be summarised in a separate appendix (E2) to be published electronically on the SCPHRP website.

Not all identified studies were sufficiently novel or relevant after scrutiny to be included.

The scan also draws upon many government documents, web-published material and other grey literature prompted by citation tracking and consulting original source documents and data.

Other sources

- Consultation with established UK experts (Phillip Insall, Nick Cavill)
- Third sector organisations (principally SUSTRANS)
- Local dedicated research teams (SPARCOL)
- Collaboration with a public health policy researcher at NHS Lothian Health Board
- Four expert invited reviewers for comments on the first complete draft.

1.4 Structure and purpose of this report

The breadth and complexity of all environmental influences and societal drivers which might impact on obesity and which were set out comprehensively in the UK Government's Foresight Report on the subject [2] provide some insight into potential targets for preventative interventions but do not readily lead to a well-defined research question, or even series of questions. The nature of the associated problems that underly obesity are also not especially suitable for classical randomised study designs, which constitute the highest standard of scientific evidence for deciding which interventions might be the most effective. The current report therefore, is intended principally to present a summary of the best evidence available within a framework that we hope will be of most use to policy makers. Thankfully, there are a number of very useful ecological models that help to clarify and highlight potential environmental and policy interventions, some of which have already been implemented in other parts of the world (and which are discussed in the course of the document). In terms of making use of available evidence, the scan follows a pragmatic approach and aims to present potential interventions in the context of their likely population impact as well as the strength of evidence as it currently stands in the literature (see section 2.7 and table 2.4).

Chapter 2 – Obesity in adults

2.1 Defining obesity

Obesity can be defined as the accumulation of excess fat to the extent that it can seriously impair normal bodily health and functioning. While it is recognised that some people are more genetically susceptible than others, the direct cause of obesity in an individual is an excess of energy intake over expenditure. The most widely accepted clinical definition of obesity in adults is based on body mass index (BMI) which is defined as a person's weight in kilograms divided by the square of their height in metres (kg/m^2). The standard categories for obesity classification for adults are shown in table 2.1.

Table 2.1 Classification of overweight and obesity in adults [3]

BMI range (kg/m^2)	Classification
<18.5	Underweight
18.5–24.9	Healthy weight
25.0–29.9	Overweight
30–34.9	Mildly obese (obesity I)
35–39.9	Moderately obese (obesity II)
40+	Morbidly obese (obesity III)

In the case of children, the UK national BMI percentile classification has been the most used for reporting obesity. Children are defined as overweight or obese if their BMI falls above the 85th and 95th percentile respectively of the UK 1990 reference chart for age and sex.

2.2 Obesity as a public health priority

The direct and indirect consequences of treating obesity are considerable. Obesity reduces life expectancy by an average of 9 years and is strongly related to a number of serious diseases, most notably heart disease, type II diabetes and certain cancers. The likelihood of developing diabetes type II for instance is almost 13 times higher for women who are obese and 5 times higher for obese men (table 2.2). The risk of major cardiovascular events in a cohort of British men aged between 40 and 59 with no prior history increased by 6% for each 1 kg/m^2 increase in BMI [4].

Table 2.2 Classification of overweight and obesity in adults [3]

Disease	Relative risk for women	Relative risk for men
Type II diabetes	12.7	5.2
Hypertension	4.2	2.6
Myocardial infarction	3.2	1.5
Cancer of the colon	2.7	3.0
Angina	1.8	1.8
Gall bladder disease	1.8	1.8
Ovarian cancer	1.7	–
Osteoarthritis	1.4	1.9
Stroke	1.3	1.3

(Source: National Audit Office 2001²)

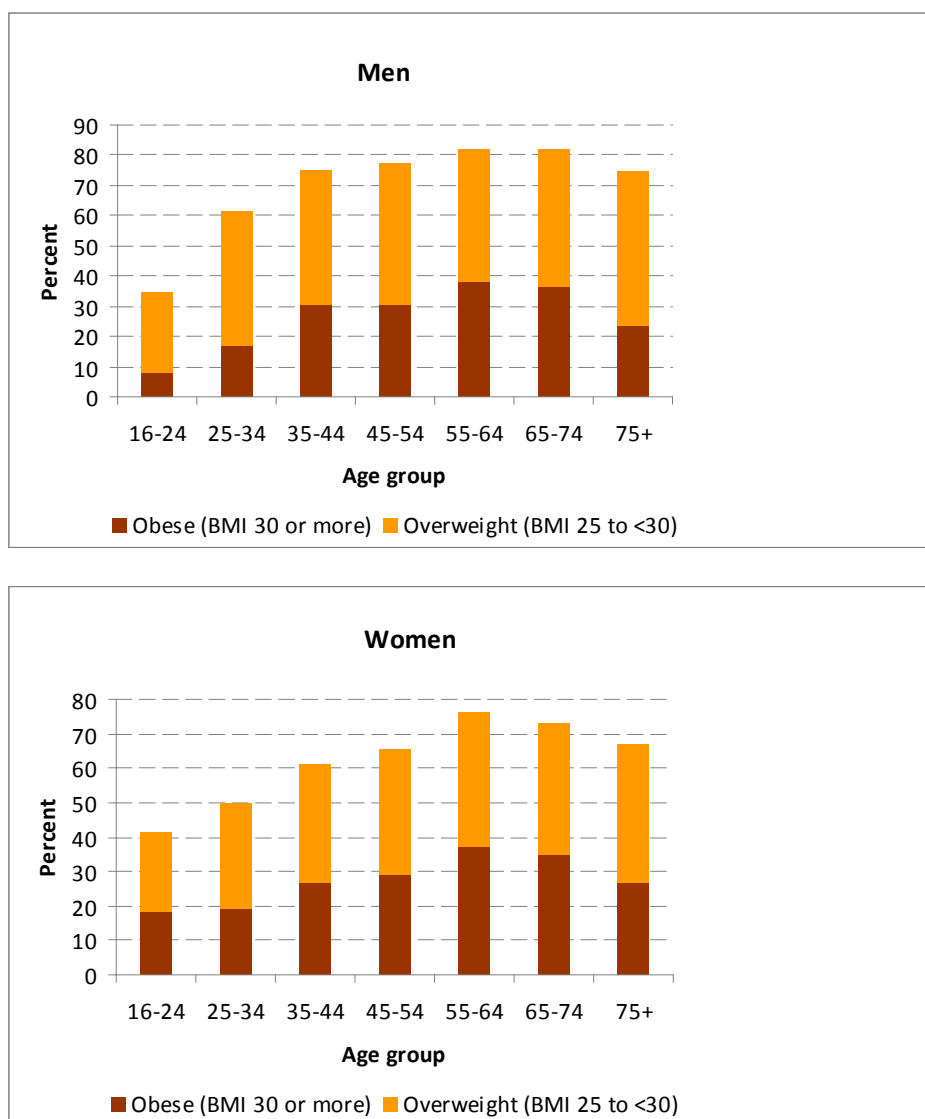
In addition to increasing the risks of ill health, obesity significantly increases the risk of mortality at any given age. For midlife adults (50 to 71 years old), who have never smoked, the all cause mortality risk increases by 20% to 40% in overweight persons and by 200% to 300% in those who are obese [5]. There is also a link between mortality risk and the duration of overweight, with those who have been overweight for longest being at the highest risk. Severely obese individuals are likely to die on average 11 years earlier (13 years for a severely obese man between 20 and 30 years of age), than those of a healthy weight. This risk is comparable to, and in some cases worse than, the reduction in life expectancy from smoking. Extrapolations in the government's recent Foresight report [2], suggest that by 2025 for the UK population as a whole, something in the region of 40% of adults could be obese.

2.3 The epidemiology of obesity in Scotland

The Scottish Public Health Observatory report in 2007 [6] confirmed the status of obesity as one of Scotland's most serious public health problems (as is also the case for the rest of the UK). The report sets out how obesity levels in both adults and children have risen steadily over the last 10 years with marked increases in men aged 35–64 years and in women aged 35–44 years. Among its key findings are:

- The prevalence of obesity (BMI > 30 kg/m²) in Scotland has increased over the past two decades, reaching 22% in men and 24% in women in 2003, with marked increases in (working age) men aged 35–64 years and in women aged 35–44 years
- The prevalence of obesity clearly increases with age throughout most of the life-course in both men and women (figure 2.1).

² Tackling Obesity in England. National Audit Office 2001. http://www.nao.org.uk/publications/0001/tackling_obesity_in_england.aspx

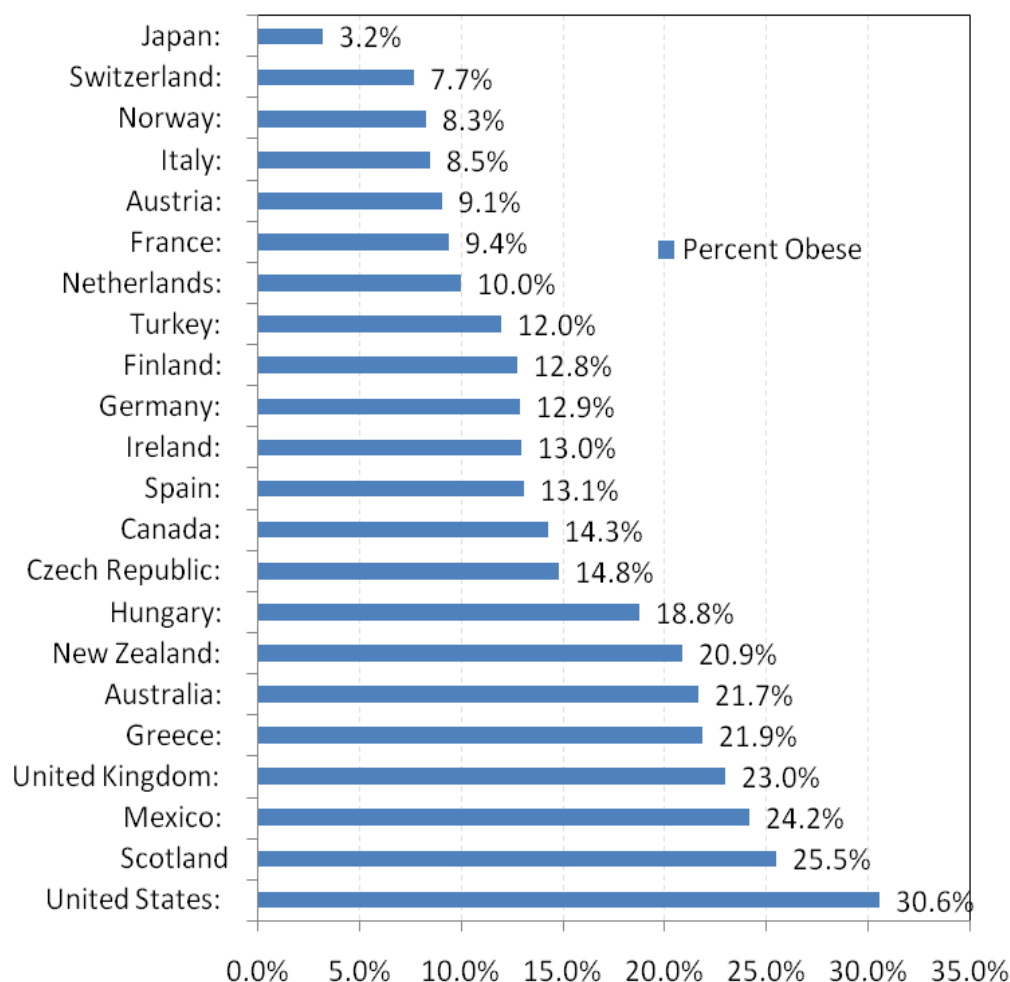
Figure 2.1 Prevalence of obesity and overweight in Scotland by age band, 2008

(Source: Scottish Public health Observatory, 2010.³)

- While overall obesity prevalence is not related to deprivation at the population level, there is evidence of an inverse association in women with higher levels of obesity in lower social groups
- Obesity in children is now common. In Scotland, nearly one in five (18%) boys and approximately one in seven (14%) girls aged 2–15 years are classified as clinically obese
- It is estimated that obesity in Scotland is presently linked to nearly 500,000 cases of high blood pressure, 30,000 cases of type II diabetes, and similar numbers of cases of osteoarthritis and gout
- Obese people in Scotland are 18% more likely to be hospitalised than those of normal weight.

Levels of obesity in Scotland and England are broadly similar for men, although Scotland has higher levels of obesity among women. International comparisons show that Scotland has relatively high levels of obesity compared with other OECD countries (figure 2.2). This combined picture provides little reassurance that traditional approaches to obesity, which were largely based around appeals to individual lifestyle change, have had any measurable impact. It is probably too early however to comment on more recent policy initiatives such as UK Change4Life (see chapter 7) regarding any impact on the trend on obesity and overweight.

³ Scottish Public Health Observatory, ISD Scotland (<http://www.scotpho.org.uk/home/home.asp>)

Figure 2.2 Obesity in OECD Countries: % adult population (≥ 15 years) with a BMI ≥ 30 kg/m²

(Source: OECD health data, 2006)

Given the adverse consequences for individual and population health, the current estimated direct linked costs of obesity to the NHS in the UK are estimated to be around £4.2 billion [2] (the last available estimate for total NHS treatment costs in Scotland was in 2001 at £171 million).

Additionally, international evidence suggests that the risk of death among obese people is two to three times higher than people of normal weight due to 'all-cause mortality' across all age ranges [7]. The Foresight Report on likely future challenges of obesity gave an estimate of around £16 billion for the costs to the economy as a whole, rising to £50 billion per year by 2050 if left unchecked. The UK's entire Gross Domestic Product at September 2009 is £316 billion⁴. Such a financial burden to the wider economy, to say nothing of the effects on the quality and length of life experienced by current and subsequent generations, is clearly unsustainable.

⁴ Office for National Statistics; September 09 <http://www.statistics.gov.uk/instantfigures.asp#bopt>

2.4 Key drivers of obesity

Conceptually, the causes of obesity at the individual level are intuitively self explanatory. Weight gain and eventually obesity occur when energy intake from food and drink is greater than all energy expenditure through the body's metabolism and physical activity over a prolonged period of time, resulting in the accumulation of excess body fat. While there is some evidence that some individuals may be genetically more susceptible to developing obesity, the steeply rising prevalence of obesity and overweight in the past thirty years cannot begin to be accounted for by heritable/genetic factors.

Indeed the evolution of capacity to efficiently store excess food energy in times of scarcity has no doubt played a pivotal role in human evolutionary success. Such capabilities however are clearly maladaptive in modern westernised societies where energy dense rich foods are plentiful, affordable and heavily promoted by sophisticated commercial interests. Add to this the rise of motorised transport, sedentary employment patterns and the diminishing requirements for physical effort in the home and at work, and it is hardly surprising that rates of obesity and overweight continue to rise at every stage in the life-course.

An improving understanding of causal factors however has not led so far to the development of any notably successful solutions or preventative strategies that have demonstrated any great promise in reversing the underlying trend towards an increasingly overweight population. The problem is also no longer confined to developed economies such as Europe and the US, since some of the most dramatic increases are currently occurring in developing countries and in the newly emergent economies of India and China [8, 9]. In spite of the now widespread international acknowledgement of the true scale of the problem, with many governments making proclamations about the need for urgent action, no country in the world has yet managed to successfully halt or reverse the rising obesity trend.

The emphasis to date in many countries, including the UK, has been quite strongly focused on aspects of individual behaviour, without addressing the powerful underlying societal drivers which permeate every aspect of modern life. The Foresight Report [2] for instance refers to a 'complex web of societal and biological factors that have in recent decades, exposed our inherent human vulnerability to weight gain'. The report presented an obesity systems map⁵, on which over one hundred variables are identified that directly or indirectly influence energy balance at the centre of the diagram. For simplicity the Foresight map has been divided into 7 cross-cutting predominant themes:

- **Biology:** an individual's starting point reflecting the influence of genetics and baseline physical health status, as well as early life programming effects and internal appetite control mechanisms
- **Activity environment:** the influence of the environment on an individual's activity behaviour, for example a decision to cycle to work may be influenced by road safety, air pollution or the provision of a cycle shelter and showers at work
- **Physical activity:** the type, frequency and intensity of activities an individual carries out, such as cycling vigorously to work every day
- **Societal influences:** the impact of society on individual behaviour, for example the influence of the media, education, peer pressure or culture
- **Individual psychology:** for example a person's individual psychological drive for particular foods and consumption patterns, or physical activity patterns or preferences. Also includes issues around stress coping skill, self-esteem and self-efficacy
- **Food environment:** the influence of the local, national and even global food environment on an individual's food choices. At the local level for example, a decision to eat more fruit and vegetables may be influenced by the availability and quality of fruit and vegetables near the home. Regional and national influences cover all arrangements for food production and distribution as well as trade agreements and incentives which influence them
- **Food consumption:** the quality, quantity (portion sizes) and frequency (snacking patterns) of an individual's diet.

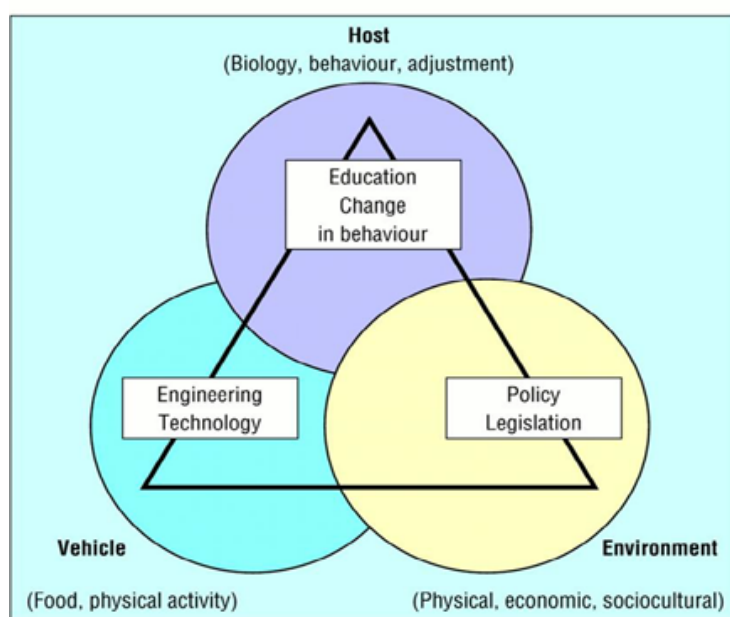
⁵ The full obesity systems map (Figure 8.4 in Foresight Report): http://www.bis.gov.uk/assets/bispartners/foresight/docs/obesity/obesity_final_part5.pdf

The systems map developed in the Foresight document certainly illustrates the complexity of the task facing policy makers in trying to develop solutions to increasing obesity prevalence. In addition to the largely individually oriented behavioural measures adopted to date in the UK (such as the Department of Health in England's Change4Life campaign⁶), policy development itself is constrained by a great diversity of analyses as to what might be the most critical leverage points. Lang and Rayner [10] have referred to this situation as a 'policy cacophony' where the 'noise' of competing proclamations of where action needs to be taken, 'drowns out the symphony of effort'. They highlight that it is the innate conservatism of most governments that drives them to resort to individual behaviour-based models, but that what is actually required is a comprehensive coherent approach looking at all sectors of society, which is also strongly advocated by the Foresight team. Encouragingly, policy initiatives which will be discussed in subsequent chapters (e.g. food labelling in section 5.2 and cycling demonstration towns in section 5.4), could have been seen (until recently at least), as signs that the case for more environmentally orientated interventions may be starting to be heard.

2.5 The obesogenic environment

The term obesogenic environment was first coined by Egger and Swinburn in 1997 [11] to describe the numerous embedded societal drivers at the root of increasing population weight gain in modern westernised societies. The same report also introduced a simple ecological model based on the epidemiological triad which was originally introduced for modelling infectious diseases.

Figure 2.3 The epidemiological triad applied to obesity. For obesity, 'host' encompasses the biological and behavioural influences, plus physiological adjustment. 'Environment' is similar in the two models, and 'vehicle' (or 'proximate drivers') can be seen as the combination of all energy intake (food/drink) and all energy expenditure (physical activity).



(Source: Egger and Swinburn, 1997 [11])

The conceptual parallels between the obesity pandemic and the 'triad' model help to illustrate that the driving forces which are responsible for increasing obesity prevalence are predominantly or two-thirds 'external' to the individual, as opposed to being substantially attributable to host factors. Most importantly, the close comparison that this model then encourages with other major public health issues such as smoking reduction, injury prevention and infectious diseases [12] reinforces the point that success is not likely to occur until environmental influences are addressed. Swinburn and colleagues

⁶ Change4Life - Eat Well, Move More, Live Longer <http://www.dh.gov.uk/en/Publichealth/Change4Life/index.htm>

also developed a categorisation system for the different aspects of the obesogenic environment, which has been used to classify intervention measures aimed at addressing obesity [13]. The ‘analysis grid for environments linked to obesity’ or ANGELO framework, provides a means of identifying and categorising obesogenic characteristics of the external environment, so that their relative importance in any particular setting can be examined as a prelude to prioritising interventions. The framework distinguishes four broad environmental categories or domains of influence (physical; economic; legislative and sociocultural) and two levels of scale: micro (local / institutional) and macro (regional/national).

Table 2.3 Analysis grid for environments linked to obesity (ANGELO)

Domain \ Scale	Micro-environment (settings) (e.g. household, community)	Macro-environment (sectors) (e.g. regional, national)
	Food Physical activity	Food Physical activity
Physical	What is available? For example, buildings, amenities and land use patterns.	
Economic	What are the monetary cost factors/influences/consequences?	
Legislative	What are the rules/legal guidance/policy messages?	
Sociocultural	What are the attitudes, beliefs, perceptions and values?	

(Source: adapted from Swinburn *et al*, 1997 [13])

Further detailed definitions and examples of what constitutes each environmental domain, are explored in chapters 3 to 6 of this report, but in brief they can be thought of as:

- **Physical:** Not just the physical world, but also relates to availability of softer resources like training and information, technological innovations and expertise
- **Economic:** All monetary considerations associated with nutritional and physical activity environments including incentives, penalties and societal costs
- **Legislative⁷:** All rules and regulations (e.g. micro can be household or school/workplace and macro refers to regional/national legislation)
- **Sociocultural:** Refers to social and cultural norms in relation to food and physical activity (subject to variation at all levels from individual/household to ethnic/religious/cultural).

The introductory paper applies this framework in several Pacific Island communities which are acknowledged as having some of the highest levels of obesity and overweight in the world. While there are a number of different frameworks available for categorising policy and environmental interventions [14–16,] ANGELO enables policy makers to ensure that they have a balanced approach across all four domains, methods of intervention and settings. Most importantly ANGELO has been piloted at the population level for use in prioritising interventions by rating for validity (evidence of impact), relevance (to local context) and potential magnitude of effect [13]. The approach has also now been applied for ‘whole-community’ demonstration projects across diverse population groups [17]. A recent high-quality systematic review from Canada [18] on the influence of the urban environment on healthy weights was also structured around the ANGELO framework.

Since the ultimate goal of obesity prevention and control at the population level is to engineer ‘a shift in the curve’ in the population distribution of obesity [19], there is an emerging consensus that public health efforts need to be universal, rather than targeting any particular risk groups, and that the greatest chance of sustainable success lies with an ‘incremental small changes strategy’ [20]. Because weight gain can occur over time with very minor daily energy surpluses, small scale energy deficits might be more practicable and habit-forming than major lifestyle alterations. Of course small changes by definition are difficult to measure, which becomes problematic when trying to evaluate their effectiveness at the population level.

⁷ Within the original ANGELO classification, the term Policy is used for the Legislative domain used to describe laws and regulations. For the purposes of categorizing interventions in this document however, ‘legislative’ was deemed to be more specific, since policy measures in a UK context could equally apply to any domain.

2.6 Appraising evidence for obesity prevention

The question of how best to tackle obesity has been described as a perfect illustration of the magnitude of the mismatch that is often seen in public health between the scale of a problem and the adequacy of evidence on the effectiveness of interventions to tackle it [21]. An increasing sense of urgency to undertake some form of action, can compound the problem by neglecting to allow for proper consideration of how new programmes should be evaluated. Those interventions which have high capital investment costs (e.g. changes to transport infrastructure), or which involve challenging vested interests (e.g. the food industry) also need to be able to demonstrate strong evidence of likely effectiveness if they are to be implemented [22]. The term ‘evidence-based’ is itself in one sense problematic, since it is generally understood to be analogous to the evidence-based medicine (EBM) frame of reference. An EBM perspective strongly weights internal validity (robust answers in a controlled environment such as a clinical trial), over external validity (i.e. generalisability across different populations/settings and which takes account of social, cultural, political and commercial considerations). Many public health experts point to the overwhelming influence of the latter in their work at the population level and suggest that the overriding question needs to be not ‘what should work?’ but rather ‘what does work sustainably, under the prevailing conditions?’.

Given that the focus of this report is obesity prevention, there are three fundamental considerations which are central to the search for evidence which are summed up very succinctly in chapter 2 of the US Institute of Medicine’s recent report entitled ‘Bridging the Evidence Gap in Obesity Prevention [23]: First is the need to distinguish prevention from treatment in order that the population level focus is maintained rather than targeting the already overweight (at which point ‘weight loss’ risks becoming the main objective). Second, the ultimate aim of prevention is a reduction or stabilisation in population BMI levels which implies that the absence of an increase or a reduced rate of increase can both be valid measures of success; third, favourable impacts on BMI outcomes are achieved through effects on four types of intermediate outcomes: organisational; environmental; socio-cultural (includes prevailing beliefs and values) and behavioural. By implication therefore, many strategies aimed at obesity prevention may not be expected to have a direct impact on BMI, but rather on pathways that will alter the context in which eating, physical activity and weight control occur. Any restriction on the concept of a successful outcome, to either weight-maintenance or BMI measures alone, is therefore likely to overlook many possible intervention measures that could contribute to obesity prevention.

Following the above logic, the current report draws upon a wide range of studies and types of investigation. In some areas of prevention, evidence is restricted to aetiological studies in which the focus is attempting to quantify the contribution of certain behaviours or environmental characteristics to population obesity and thereby design logical interventions. For more advanced areas of enquiry, it is possible to report on large-scale prospective studies and intervention trials, as well as robust institutional studies with defined sub-populations such as those in workplaces. The difficulty of measuring some of the critical intermediate outcomes (such as small changes in consumption or activity) combined with a very broad range of investigation methodologies, means that traditional hierarchies based on study design, such as EBM mentioned above, are generally too blunt an instrument to assess the likely potential for obesity prevention. The need to proceed on the basis of an imperfect evidence base also calls for a framework that can adequately accommodate diverse sources of evidence (in relation to outcomes being measured), as well as scientific uncertainty.

The ‘portfolio matrix’ developed by Swinburn and colleagues [24], represents one of the most promising methodologies for assisting policy makers in judging the merits of new policy suggestions, in that it is very much designed to take account of the likely level of uncertainty and balance this against the potential population impact of any proposal of interest. Essentially following the same logic as a financial investment portfolio, it provides a theoretical means for planning interventions or ‘public health investments’ across a range of options in such a way as to be able to maximise returns. Within the matrix itself, ‘certainty of effectiveness’ as judged on the basis of experimental and observational studies,

equates to 'level of risk' and potential population impact is interpreted as the potential scale of returns or benefits over time. The approach allows for a straightforward cross-tabulation where the end judgements about interventions are categorised on a stepwise scale from 'most promising' to 'least promising' (table 2.4). The use of the portfolio matrix is discussed further in chapter 8, where it has been used to categorise the interventions covered in the evidence review sections of this report.

Table 2.4 Portfolio matrix for categorising potential interventions

Certainty of effectiveness*	Potential population impact#		
	Low	Moderate	High
High	Promising	Very promising	Most promising
Moderate	Less promising	Promising	Very promising
Low	Least promising	Less promising	Promising

*Certainty of effectiveness – judged by the quality of the evidence, the strength of the programme logic as well as the sensitivity and uncertainty parameters in the modelling of the population impact (adapted from Swinburn *et al*, 2005 [25]).

#Potential population impact takes into account intervention efficacy (impact under ideal conditions), combined with 'real-world' reach and uptake and generally reflects effectiveness at the societal level, weighted for relative baseline 'burden of attributable illness'.

2.7 Towards a coherent obesity strategy

The most comprehensive 'obesity prevention' manifesto produced to date at a national level is arguably the UK Government's *Healthy Weight, Healthy Lives* strategy for England,⁸ first published in 2008. The document sets out five priority areas for government action based around reducing the consumption of high energy foods, incorporating physical activity into everyday life and a focus on early years, with targeted support for those most at risk. Sweden has also developed an action plan setting out a series of costed proposals [25], although it is more a statement of intention than a set of planned interventions. There is also an increasingly sophisticated body of evidence from observational studies, around the potential for addressing environmental factors that could potentially contribute to obesity prevention efforts by closing the surplus energy gap [26]. A number of robust studies and reviews have gone further and linked sustained population weight benefits with deliberate environmental interventions. International comparisons have also shown that even relatively impoverished countries can substantially improve their population's eating behaviours (e.g. Ghanaian import controls discussed in section 5.2) and the take up of opportunities for increasing physical activity (e.g. mass public cycling in Columbia discussed in section 6.4), where there is a will to create them.

This report will present the results of a rapid literature review in a format that we hope will be a useful resource for decision makers and policy analysts at all levels. Using the ANGELO framework together with the portfolio matrix to categorise potential interventions according to sector, setting and nutrition/activity focus, the report will summarise the current evidence and prospects for a series of environmental and policy options that could be directed at obesity prevention in Scotland. The level of scientific certainty associated with each potential intervention, will be tabulated against its likely population impact, based on evidence retrieved from published studies, and its likely transferability to a Scottish context.

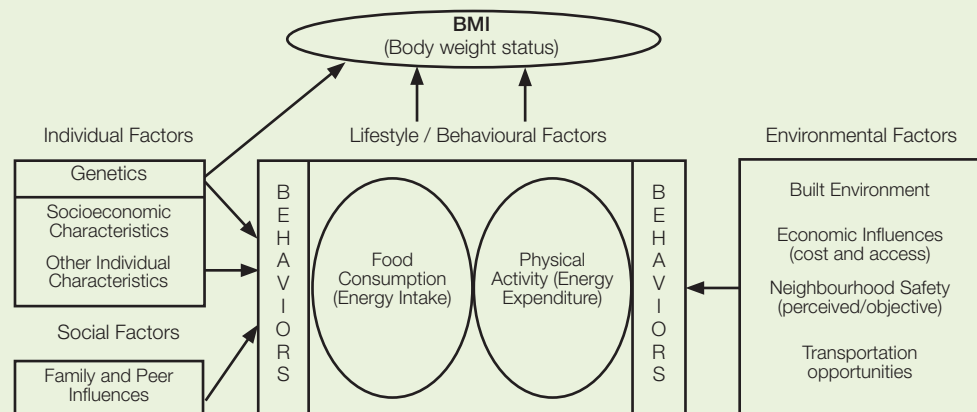
⁸ Healthy Weight, Healthy Lives: A Cross Government Strategy for England. Department of Health (2008); http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_082378

Chapter 3 – The physical environment

3.1 Ecological model for physical environment

The physical environment in this review will be broadly interpreted as covering all residential and activity space as well as the connections between these two spheres. For adults this will include home, work and recreation environments, as well as the means of travel between them. One relatively comprehensive ecological model which illustrates the basic interrelationships that connect aspects of the built environment to obesity, is that produced by Powell *et al* at the University of Illinois (figure 3.1):

Figure 3.1 Ecological model relating the physical environment to physical activity, diet and body weight, BMI (body mass index)⁹.



3.2 Nutrition interventions (macro-level)

Features of physical surroundings which affect food purchasing and consumption at the macro-level, include regional and national distribution of retail premises and other sector level groupings of industries, services or supporting infrastructure. Early observational research in this area was dominated by US-based studies, which showed that lower socioeconomic groups had poorer access to supermarkets and by extension to affordable healthy food. More deprived areas also had increased concentrations of smaller grocery stores and non chain supermarkets, which traditionally have a poorer range of fresh produce and where items are generally more expensive [27]. Pronounced ethnic and racial disparities in access were also uncovered in the US studies, with ethnic minority areas having a much reduced concentration of supermarkets, which in turn is associated with an increased prevalence of obesity [28]. Follow-up investigations of 'food desert' areas demonstrated that African-American fruit and vegetable intake showed a significant stepwise increase with each additional supermarket in the local census tract (e.g. for two or more supermarkets within census tract, the likelihood of African-Americans consuming fruit and vegetables was over two-fold higher RR=2.18; 95% CI: 1.57 to 3.03) [29]. Conversely neighbourhoods with higher levels of ethnicity and social deprivation also had higher concentrations of fast food restaurants [30]. In a state level cross-sectional analysis, Maddock found a significant correlation between the number of residents per fast food outlet and obesity prevalence ($r=-0.53$; $P<0.001$) [31].

⁹ Reproduced with the permission of Lisa Powell *et al*, Bridging the Gap Program Office, Institute for Health Research and Policy, University of Illinois at Chicago <http://www.impactteen.org/otherpapers.htm>.

In spite of government declarations and policy announcements to the contrary [32], attempts to extrapolate the 'food desert' hypothesis to a UK setting have found the situation to be a lot less clear cut. Although one report from inner London did demonstrate restricted access to recommended foods in more deprived areas [33], larger scale studies in other major cities did not find any significant association. A Food Standards Agency commissioned report in 2004, found that the vast majority of households in a major city in the north east of England, did their food shopping at large supermarkets and that local retail provision was not a key determinant of diet quality [34]. A more recent Glasgow based study [35], found that the most deprived quintile of areas had the greatest mean number of total food retailers per 1,000 residents, while quintile 1 (least deprived) had the least. In relation to types of outlet, the investigators also found no significant differences between the mean numbers of bakers, fruit and vegetable shops, fishmongers, supermarkets or delicatessens per 1,000 residents. They also noted however, that variation within their categories of premises could not be ruled out and that further work was ongoing to characterise more fully the nutritional value of foods from different types of outlet.

Although the density of fast food outlets was not associated with deprivation in Glasgow [36], a cross-sectional survey, which focused on twelve fresh fruit and vegetable items in 288 food stores from ten communities across Scotland, found that the fresh produce in more deprived areas tended to be of a lower quality [37]. The survey also examined variation by store type and by rural-urban location, the second of which has particular relevance outside of Scotland's central belt and is often overlooked in studies of this type. Although the overall quality of fruit and vegetables was high, there was a notable variability by store type and location with the best quality found in medium sized stores, stores in small towns and in rural areas, as well as those in more affluent areas. While not all differences in quality were statistically significant, the patterns were consistent for the majority of the twelve selected fruit and vegetable items [37].

A quasi-experimental study in the east end of Glasgow sought to assess the effects of new large scale retail provision on the purchasing frequencies of fruit and vegetables [38]. The authors were not able to replicate findings from an earlier uncontrolled study and there was no evidence for a net intervention effect on fruit and vegetable consumption, although a low response to the initial questionnaire (less than 20%) and a relatively high baseline consumption level of fruit and vegetables, gave rise to doubts over the capacity of the survey instrument to detect an increase. Intriguingly, from the results on general health measures, there was a significant reduction in the prevalence of 'fair to poor' and 'poor' self-reported psychological health in the intervention group as assessed by the standard health survey tool GHQ-12. On the other hand, regression-to-the-mean and 'attention or 'learning' effects cannot be ruled out with this study design.

Table 3.1 Study participants (N=1,145) measure of weight and waist circumference at baseline (2006–07) by neighborhood walkability and density of fast food restaurants

Neighborhood walkability (high vs low) ^a	Density of fast food restaurants (high vs low) ^b			
	Weight (kg)		Waist circumference (cm)	
	High	Low	High	Low
High	82.83	84.08	96.09	98.54
Low	88.46	85.43	100.36	98.62

(Source: Li, Harmer & Cardinal *et al*, 2009 [39])

^a Defined by percentile scores: high walkability= 75th percentile, low walkability=<75th percentile; high=34 neighbourhoods, low=86 neighbourhoods.

^b Defined by percentile scores: high density= 75th percentile, low density=<75th percentile; high=30 neighbourhoods, low=90 neighbourhoods.

Returning to US-based evidence, a recent highly powered follow-up study reported on actual weight changes over the course of one year, in relation to both features of the neighbourhood environment and underlying behavioural preferences [39]. Specifically, among people who reported frequent visits to fast food outlets, residence in a neighbourhood with a high density of fast food outlets was associated with a significant increase in weight (mean=+1.4 kg) and waist circumference (mean=+2.06 cm) (table 3.1). While the strength of evidence is greater than for cross-sectional studies and serves to highlight the subtle interplay between behavioural and environmental factors, there is still the potential for self-selection, where those inclined towards less healthier behaviours seek out surroundings that will support those choices [40]. A similar chicken and egg ‘feedback’ conundrum surrounds the likely tendency of shops selling unhealthy foods to locate themselves in more deprived areas, or modify their stock according to local demand [41]. The following section on micro-food environments (3.3) picks up on some of these issues.

Summary

Nutrition interventions (macro-level)

- Higher densities of fast food outlets in socially deprived and in African-American neighbourhoods in the US, are not seen to the same extent in relatively deprived areas / predominantly ethnic minority localities of UK towns and cities.
- Physical proximity to affordable food choices does not appear to be a strong determinant of a healthy diet in UK settings, although there is some evidence for Scotland that local variations in the quality of available fresh produce may influence dietary intake.
- An improving international and UK evidence base in this area clearly demonstrates an influence on specified weight outcomes of local environmental characteristics, but only in so far as they facilitate or exacerbate existing preferences and behaviours.

3.3 Nutrition interventions (micro-level)

Glanz *et al* describe four broad settings in their ecological model of food availability and choices [42], these being: (i) community, (ii) organisational, (iii) consumer and (iv) information ‘nutrition environments’. Since consumer (retail), community and information aspects are discussed elsewhere in this report, the current section will focus on what they collectively refer to as the ‘organisational nutrition environment’ which encompasses home, work, educational settings and other ‘defined environments’ such as restaurants and takeaway/fast food vendors. The focus here is on the types of food and its nutritional value as opposed to the location and density of outlets per head of population, which was discussed previously under macro-level factors in 3.2. The important influence of portion size (mainly in restaurants) has also been the subject of a number of well conducted studies, the findings of which need to be considered. In relation to adult obesity prevention and micro-food environments, three additional subheadings are helpful to organise the major findings, these being: (i) restaurants and fast food premises; (ii) portion size and energy density; and (iii) educational settings and workplaces.

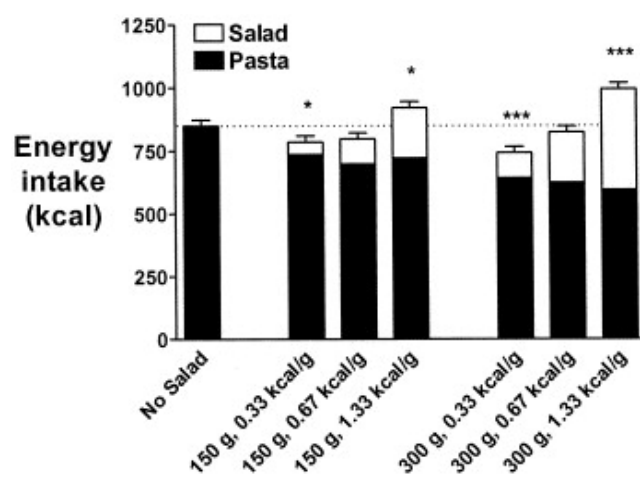
i. Restaurants and fast food outlets

Almost one third of all meals consumed by British adults are consumed outside the home [43], a proportion which has been rising steadily over the last thirty years and is similar to that seen in the US [44]. While fast food meals are known to be typically high in energy density, food consumed at full service restaurants can be as high or higher in fat, sugar and salt. Consumer nutrition environments within restaurants and other food catering premises are obviously subject to substantial variability, depending on the type of establishment and target customer group, although generally speaking the research in this area is limited. Partly in recognition of the restaurant knowledge gap, Saelens et al recently developed a nutritional surveillance/assessment tool for use with commercial catering premises and used it to characterise 217 sit down restaurants and fast food outlets across several US states in 2004 and 2005 [45]. The two types of premises differed on many nutrition environment variables, demonstrating that the frequent practice of not considering them separately could be concealing meaningful variation. Fast food outlets for instance had healthier scores on several items than sit down restaurants, including the availability of healthy starters or main dish salads. Fast food outlets were also more likely to display signage providing nutrition information and promoting healthy options, but equally, were more likely to have displays promoting unhealthy eating and overeating. While sit down restaurants were somewhat more likely to have healthier individual item options, fewer than 9% of their main dishes and 12% of their salad main dishes were considered healthy in the Saelens pilot study. The authors also highlighted very low rates of information provision on the nutritional value of menu items. This could conceivably exacerbate over-consumption in restaurants where there is evidence that consumers routinely underestimate energy and fat content, especially of starter dishes [46].

ii. Portion size and energy density

Steadily increasing food portion sizes in both out-of-home eating environments and commercially pre-prepared meals, are widely considered to have contributed to rising obesity levels, particularly in the US and other developed economies [47] and several well conducted studies have confirmed the influence of increasing portion size on increased consumption [48]. The review by Ello-Martin and colleagues also highlighted studies which had considered the interactions between portion size and energy density and found them to have independent effects that combine synergistically to affect overall energy intake. Specifically, restaurant diners consumed the most energy when served the largest portion of the highest energy dense starter-meal and the least when served the smallest portion of the lowest energy dense starter, despite their being no differences in self-rated hunger, or fullness between the two conditions (see figure 3.2) [49].

Figure 3.2 Mean \pm SEM meal energy intake after consumption of compulsory first course salads that differed in portion size (in grams) and energy density (in kilojoules per gram). Difference in meal intake compared with consuming no salad: * $p < 0.05$; *** $p < 0.0001$.



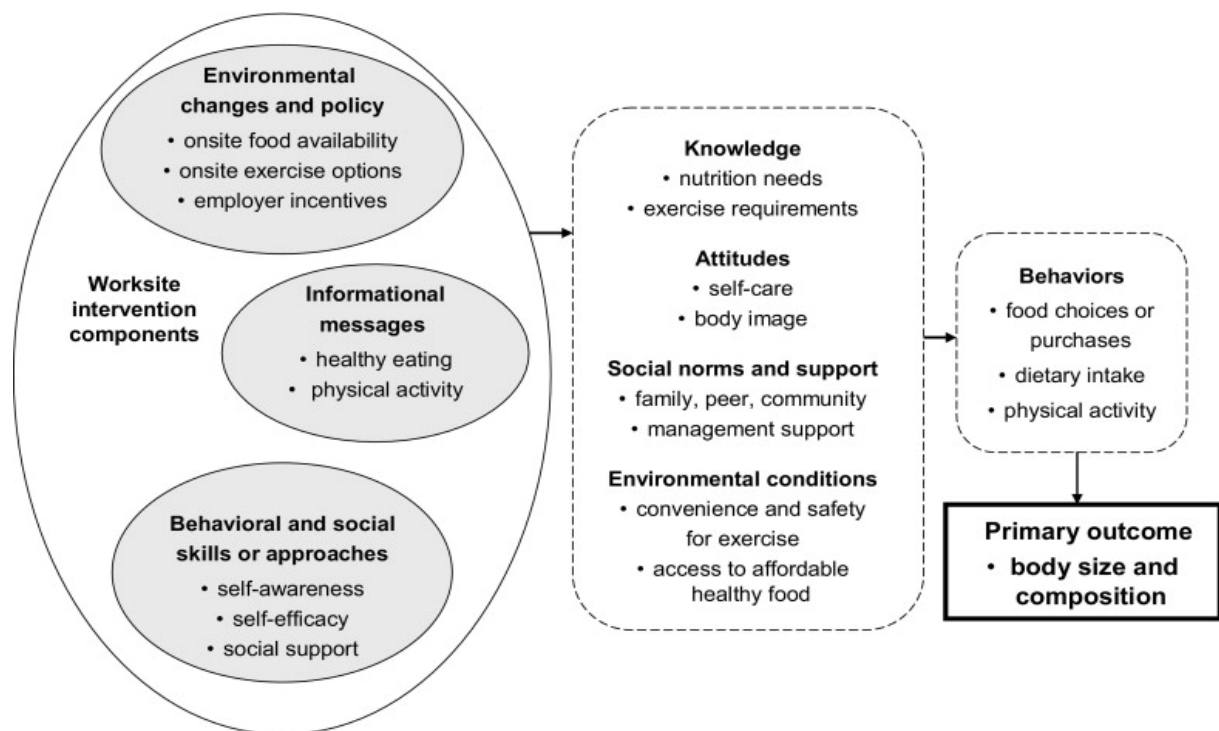
(Source: (Rolls et al, 2004) [49]).

The apparent independence of these influences with respect to fullness does, the authors suggest, indicate that smaller size portions of less energy dense dishes need not affect satiety and could present a useful means of reducing energy intake in restaurants. Steenhuis and Vermeer recently confirmed the clear relationship between portion size and energy intake in a 2009 review across a wide range of settings [50], but regretted that so far there have been relatively few intervention studies to examine the effectiveness of reducing portion size. They cite a qualitative study of consumer attitudes which found that the provision of a wider range of portion sizes and prices was the most acceptable ‘facilitator’ of lower energy intake [51]. They also recognise however that the effectors of larger portion sizes are integrated into many aspects of the food, consumer and behavioural environments, as well as being underpinned by commercial imperatives and economic considerations. As a result, their suggested model for implementing food portion interventions employs a similar multi-level framework as the current report, covering individual, physical, economic, legislative and sociocultural factors.

iii. Educational settings and workplaces

In spite of some recent high profile one-offs such as the banning of trans fats in New York catering establishments [52], the extent to which nutritional environments in commercial food premises are subject to controls and restrictions is always going to be fairly limited within the current liberal political climate. Thankfully, there are other major types of organisational setting where there is a greater scope for providing a healthier range of options, the most notable and most researched being schools (and other educational establishments) and workplaces. Environmental changes in such ‘captive population’ spaces are essentially about making healthier choices more attractive than the usual or default more obesogenic option (see figure 3.3).

Figure 3.3 Analytical framework for worksite nutrition and physical activity interventions, to improve weight status.



(Source: Anderson *et al*, 2009 [53])

Greater control over ‘exposures’ also means of course that such environments are more amenable to research orientated interventions. The two drawbacks from the point of view of this report are, firstly, that evidence from schools is not likely to be easily transferable to adult settings and secondly, that the vast majority of workplace studies are based in the US. In spite of these concerns, the literature around such ‘contained interventions’ remains relatively robust, consisting of a number of well conducted studies and, as such, it is important not to overlook.

In a comprehensive Canadian review of the evidence around urban environments and healthy weight, 71 notable findings were described in relation to physical settings and food/diet/nutrition, of which 58% dealt with school environments [18]. While the most useful positive findings related to price and behavioural interventions (to be discussed in sections 4.2 and 6.4), straightforward availability factors also exerted a significant effect on dietary quality. Specifically, there were adverse negative associations between diet quality and the provision of à la carte menus, the availability of snack vending machines and the availability of fried potatoes. A recent systematic review of workplace dietary interventions by Ni Mhurchu and colleagues [54], found that workplace interventions are associated with moderate improvements in dietary intake. They also noted that there was currently a lack of well designed research studies that could reliably be used to inform estimates of effectiveness and cost effectiveness. In particular, there is a need to address the economic, policy and sociocultural aspects of the work environment which impact on diet. Work canteens for instance, which incorporate an element of food subsidisation, offer an ideal environment in which to test the potential of economic incentives to change food purchasing behaviour [55]. A series of studies by Simone French and colleagues which focus specifically on workplace price incentives is discussed in chapter 4. There have also been several other recent high quality reviews specifically dealing with health initiatives in a work environment setting, two of which focus on obesity prevention [53, 56] with the most recent adopting a broad-based health promotion approach [57]. In the first of the reviews, seven separate studies funded by the National Heart Blood and Lung Institute (NHBLI) in the US, involving a total of 114 workplaces, were reviewed by Pratt *et al* [56]. The nutrition focused environmental strategies included reducing portion sizes and modifying cafeteria recipes to lower fat contents.

From an obesity prevention perspective, a particularly promising feature of the design of the NHBLI studies, was their stated primary outcome measure of changes in BMI or bodyweight after two years of intervention. The observed changes in either of these indices however, did not reveal any consistent pattern of association in response to environmental interventions. The assumption that people will lose weight as they increase their consumption of healthy snacks also depends of course on substitution, in that the new snack choice is directly replacing a more energy dense option.

The Work, Weight and Wellness (3W) Study was a group randomised clinical trial of a multi-component intervention program conducted over two years at 30 hotel sites, including 11,559 employees on the Island of O’ahu in Hawaii [58]. Using a validated environmental checklist for workplace health promotion components (the CHEW protocol¹⁰), there were no overall medium or large correlations (table 3.2) with any of the six environmental variables that had been included (activity signs, number of stairs, stair facilitation, lunchroom nutrition, hotel nutrition signs and healthy eating prompts/posters). Stratification by hotel size however, did reveal several significant correlations, these being positive (i.e. associated with increased BMI) in medium-sized hotels for number of stairs, stair facilitation and healthy eating variables (table 3.2). Negative correlations (i.e. associated with decreased BMI; 0.50 to 1.00), were only noted for stair facilitation in small-sized hotels and lunchroom signs in large-sized hotels. It is also worth bearing in mind that the multitude of tests in this study does raise concerns over how many significant correlations might themselves have arisen by chance.

¹⁰ Checklist of Health Promotion Environments at Work (CHEW). <http://www.drjamesallis.sdsu.edu/measures.html>

Table 3.2 Correlations for environmental variables in relation to BMI

	PA signs		Number of Stairs		Stair Facilitation		Lunchroom Nutrition Signs		Hotel Nutrition Signs		Healthy eating facilitation	
	Mean (SD)	r - BMI	Mean (SD)	r - BMI	Mean (SD)	r - BMI	Mean (SD)	r - BMI	Mean (SD)	r - BMI	Mean (SD)	r - BMI
Overall	1.30 (2.74)	-0.07	4.63 (3.02)	0.15	3.49 (0.91)	-0.21	0.47 (0.90)	-0.12	0.63 (1.27)	0.09	3.11 (1.23)	0.17
Size												
<100	1.00 (1.50)	0.11	3.00 (1.12)	0.27	3.81 (0.99)	-0.59*	0.11 (0.33)	-0.20	0.11 (0.33)	-0.20	03.39 (0.53)	0.21
100-500	1.17 (3.46)	0.07	4.17 (2.69)	0.46	3.36 (0.80)	0.35 [#]	0.33 (0.65)	0.22	0.50 (1.00)	0.14	2.91 (0.92)	0.35*
>500	1.78 (2.76)	-0.65*	6.89 (3.59)	-0.18	3.34 (0.98)	-0.20	1.00 (1.32)	-0.60*	1.33 (1.87)	-0.46 [#]	3.11 (1.99)	0.23
Union:												
No	1.29 (2.85)	0.01	3.57 (1.86)	0.21	3.62 (1.01)	-0.26	0.24 (0.54)	-0.16	0.38 (0.92)	-0.12	2.98 (0.94)	0.05
Yes	1.33 (2.65)	-0.45 [#]	7.11 (3.82)	0.07	3.18 (0.54)	-0.09	1.00 (1.32)	-0.28	1.22 (1.79)	-0.18	3.41 (1.78)	0.52*

Correlation coefficient (r) interpretation guide: small =0.10 to 0.029; [#]medium=0.30 to 0.49; *large=0.50 to 1.00

(Source: Nigg *et al*, 2010 [58])

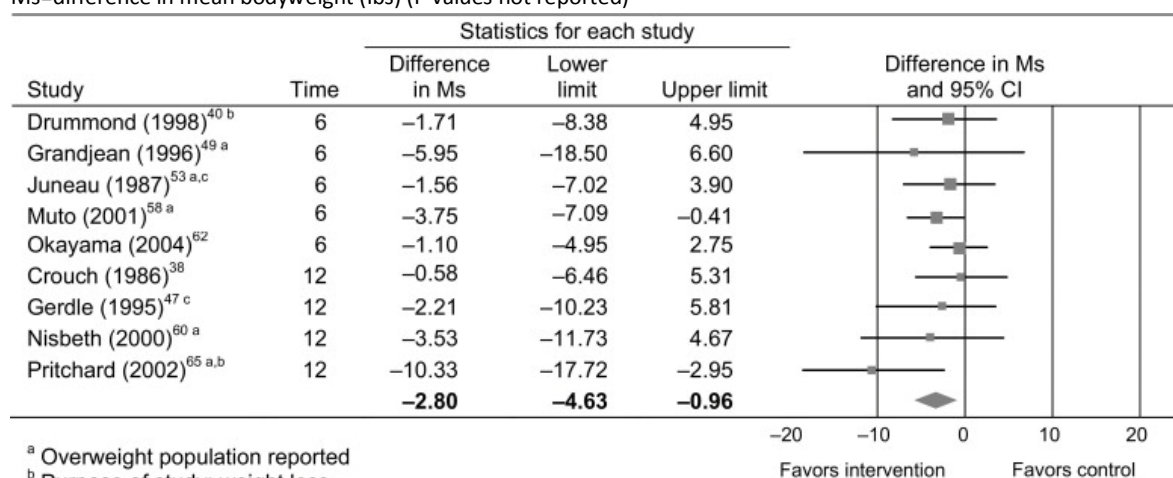
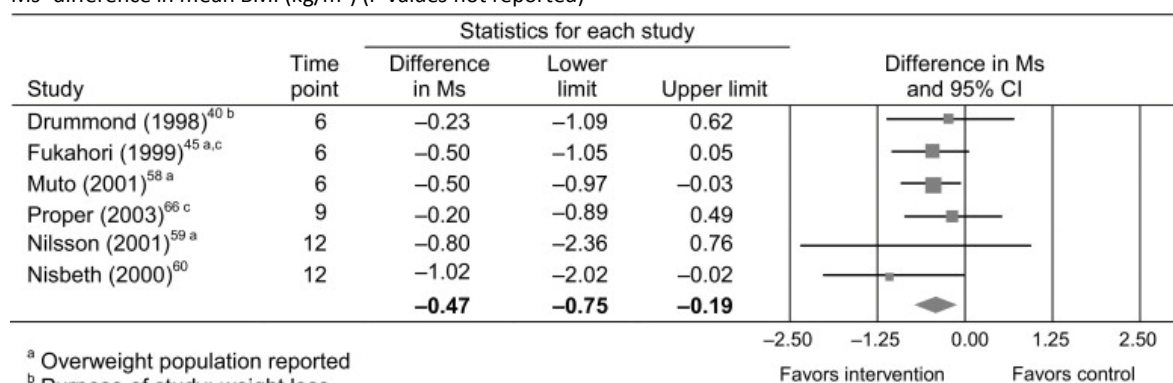
Although the use of the hotel as the unit of BMI analysis remains a recognised drawback with this study (since stratification by employee characteristics might have been more informative), the authors were nevertheless surprised to find real correlations with BMI, since environmental indicators in the CHEW checklist are expected to be linked in the first instance to proximal outcomes such as activity and healthy eating. These findings for BMI therefore, suggest that the same environmental factors are capable of exerting a significant influence on the relevant underlying behaviours of healthy eating and physical activity.

Anderson *et al* found still more encouraging results with regard to changes in bodyweight/BMI in a comprehensive systematic review of workplace interventions published under the US Centre for Disease Controls' (CDC) highly regarded guide to community preventative services programme [53]. Specifically, a pooled effect estimate of -2.8 lbs (95% CI: -4.6 to -1.0) was derived from nine randomised controlled trials (RCTs) (see figure 3.3) and a decrease in BMI of -0.5 (95% CI: -0.8 to -0.2) from six RCTs (see tables 3.2a and 3.2b). The meta-analysis component of this review is particularly useful and a rare addition to reviews of obesity prevention, due to the previously mentioned complexity of the field and heterogeneity of primary outcomes across studies. The pooled effect from the three RCTs which focused on physical behaviours alone was -2.24 lbs (95% CI: -6.49 to +2.00) compared with -3.18 lbs (95% CI: -5.88 to -0.50) in five RCTs where both physical activity and dietary behaviours were addressed.

The intrinsic difficulties in separating out diet and exercise effects are also illustrated by the NHBLI trials, which had the largest effect size (pooled effect of -10.33 lbs in a 12-month intervention for middle aged men with BMI over 25) [59]. In this study, the benefit to the group on a low fat diet was twice that of the group advised to engage in unsupervised moderate exercise. For the review as a whole, the authors were unable to draw firm conclusions about any differential effects by programme focus (activity or diet) or programme component (environmental, policy, information or skills).

Table 3.3a Impact on weight in lbs at 6–12 months in 9 RCTs

Ms=difference in mean bodyweight (lbs) (P values not reported)

^a Overweight population reported^b Purpose of study: weight loss^c Purpose of study: physical activity benefits**bold type and ◆ =overall estimate**(Source: Anderson *et al*, 2009 [53] Ms=difference in mean bodyweight (lbs))**Table 3.3b** Impact on BMI at 6–12 months in 6 RCTsMs=difference in mean BMI (kg/m²) (P values not reported)^a Overweight population reported^b Purpose of study: weight loss^c Purpose of study: physical activity benefits**bold type and ◆ =overall estimate**(Source: Anderson *et al*, 2009 [53] Ms=difference in mean BMI (kg/m²))

Multi-component approaches and structured programmes were more beneficial in general than single component and unstructured (self directed approaches). The very marginal benefits seen in a recently published, hospital based (RCT cluster design) multi-component intervention, which was also part of the NHLBI funded workplace programme, are somewhat less encouraging [60]. Lemon *et al* found no impact of the intervention on change in BMI where the estimated group difference was 0.272 (95% CI: -0.271 to 0.782) at 12 months and 0.276 (95% CI: -0.338 to 0.890) at 24 months. The predominant environmental interventions employed could certainly be described as 'low intensity', however with cafeteria signs (and stairway signs) being the most frequent measures. Lastly of course an over-reliance on workplace interventions to prevent and control obesity, runs the obvious risk of excluding those not in regular employment, who for a variety of reasons can be at increased risk of a poor diet and low levels of physical activity. The health inequalities dimension to obesity is discussed further in section 8.6.

Summary

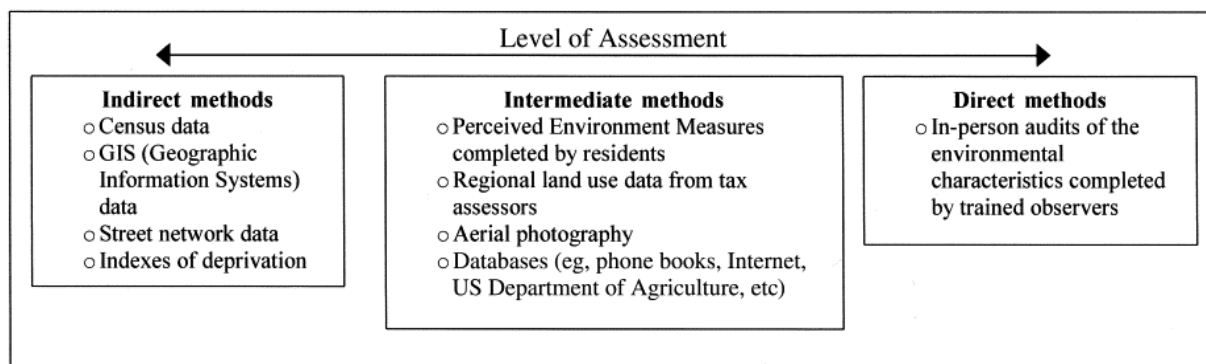
Nutrition interventions (micro-level)

- The clearest associations for increased food energy consumption in restaurants and other catering outlets have been for increases in serving portion size and energy density.
- As a strategy for reducing overall consumption, consumers and restaurant goers have expressed consistent preferences for a wider range of portion sizes to be made available, although it does not necessarily follow that this will result in more choosing smaller portions.
- In spite of variable study quality, workplace environmental interventions, including increased healthy food availability with information, have now been demonstrated to result in significant mean reductions in BMI and body weight for targeted groups of workers, across a wide range of employment sectors.
- Perhaps unsurprisingly, and in keeping with ecological models, multi-component and more intensively structured interventions are associated with the best outcomes in the workplace, although socio cultural aspects remain under researched.
- Separating out the contributions of multiple programme components can be highly problematic and is also likely to be further complicated by individual variability in responsiveness to different measures.
- Low intensity environmental interventions by themselves (e.g. information notices on healthy eating), have limited benefits within workplace settings.

3.4 Physical activity interventions (macro-level)

The widespread international consensus, that increasing population levels of physical activity will require more than merely educating individuals, has stimulated considerable research interest in the capacity of the built environment to encourage active living [61]. Specifically, transportation infrastructures which heavily favour private car travel, land use zoning policies which introduce prohibitive separation distances for walking and cycling, and an inequitable distribution of well maintained parks and recreation facilities, are all believed to contribute to inadequate levels of physical activity in many urban areas [62]. This section will briefly review the major correlation studies that have helped clarify the relative strengths of these environmental associations, including the extent to which they might apply in Scotland. For the purposes of this review, all characteristics of the external urban infrastructure such as land use and transportation routes are considered to be macro-level features. Design features within buildings, campuses or large institutions such as hospitals will be considered in turn as micro-level characteristics. An additional distinction between 'leisure based' or 'recreational' physical activity and physical activity that is integral to daily living/working/travel has also proven useful in categorising the published evidence.

Investigating the potential environmental determinants of obesity is still a relatively new field, with few publications before the year 2000. The one aspect which continues to improve, from an exposure assessment perspective, is the degree of sophistication with which built environment measurements are made. Figure 3.4 shows the continuum of methods for assessment presented by Booth *et al* in their wide ranging review:

Figure 3.4 Continuum of methods for measuring the built environment.

(Source: Booth *et al*, 2005 [63])

i. Recreational physical activity

In one of the typical early Australian studies, Giles-Corti *et al* [64] made use of both indirect and intermediate measures (figure 3.4) to show that, while controlling for social group and demographic factors in healthy working Australian adults, those who were overweight were more likely to live near highways. Both overweight and obese adults were also more likely to live in areas that lacked adequate sidewalks and nearby places for physical activity, with subjects without good access to recreational facilities having a 68% greater chance of being obese. Saelans *et al* [65] followed this up with one of the first investigations to use direct measures of activity (personal accelerometers), to find that residents of more ‘walkable’¹¹ neighbourhoods engaged in 52 more minutes of weekly physical activity and had lower body weights.

Better access to quality green space has also been associated with increased walking and physical activity, and proximal access to parks and recreational facilities has a significant impact on exercise behaviour across all age groups [66]. The addition, for example, of one fitness facility per 1,000 people per zip code and maximum ‘mixed land use’ are associated with a 1.39 and 2.60 kg/m² decrease in BMI respectively among low income women in the US [67]. A more recent Australian study [68] found that, for each inter quartile increase in ‘urban sprawl’, the odds ratios of being overweight (after controlling for individual and area co-variables), were 1.26 (95% CI: 1.10 to 1.44) and 1.38 (95% CI: 1.10 to 1.44) for being obese. Similar increased odds ratios were reported for the mediator outcomes of inadequate physical activity 1.38 (CI: 1.21 to 1.57) and for ‘not spending any time walking in the previous week’ 1.58 (CI: 1.28 to 1.93).

Frank *et al* [69] confirmed the importance of attitudes in finding that, for Atlanta residents who prefer car orientated surroundings, the availability of a local walkable environment made little difference to their activity levels or obesity prevalence. In contrast, individuals who both preferred and lived in walkable environments walked the most, drove the least and had an obesity prevalence (at 11.7%) of about half of those who preferred more car orientated neighbourhoods (21.6%). The introduction of a longitudinal component in a Harvard Alumni study [70] increased the level of sophistication by looking for changes in activity levels in response to changes in residence and therefore ‘exposure’. While comparable significant associations were found for sprawl and activity as in previous studies, the follow up work with persons who moved, did not demonstrate any increase in physical activity or decreased BMI for reductions in urban sprawl. These latter findings were certainly limited by the small numbers of men changing residence and what in the end were mostly marginal changes in associated levels of sprawl. This is likely to be a

¹¹ Assessed using an eight item walkability index called the Neighbourhood Environment Walkability Scale (NEWS) available at <http://www.drjamesallis.sdsu.edu/NEWSpdf>

reflection, the authors concede, of people's preferences for moving to comparable areas, thereby also illustrating the problem of self-selection, which remain a major threat to validity in all studies of this type.

Lastly, the Portland neighbourhood environment study deserves further mention, since just as they linked food environment features with behaviour mediated changes in weight status, Li *et al* also did the same for local walkability characteristics [39]. Specifically, high walkability neighbourhoods were associated with decreases of 1.2 kg in weight ($P < 0.05$) and 1.57 cm in waist circumference ($P < 0.05$) among residents who increased their levels of vigorous physical activity during the 1-year assessment period. This subgroup specific effect could well explain the findings of authors such as Lovasi *et al* [71], who found that individual built environment characteristics were not significantly associated with 'walking for exercise', in an independent population sample of 1,608 participants.

While the many correlation studies to date report fairly consistent physical activity and weight benefits from supportive surroundings [72], the fact that they have predominantly been undertaken in the US and Australia [62], presents real challenges for generalisability, especially with regard to relatively densely populated areas like central Scotland. This is particularly relevant for measurement concepts which have arisen such as 'walkability' and 'urban sprawl', since these are far more easily applied to US and Australian cities than their European or UK equivalents. The other key issue with neighbourhood and activity studies is that of self-selection or the extent to which people who are already predisposed to greater levels of physical activity, for example, deliberately choose to live in areas where this is better supported. At a more fundamental level, moving from aetiological studies which focus on causation, to intervention proposals aimed at obesity prevention, introduces another series of challenges. The now acknowledged extent of the increase in physical activity that would be required to have an impact on body mass, raises significant questions about the feasibility of environmental interventions to lead to favourable changes in population weight status. Incorporating more activity demands into daily living might be one way to address this deficit and measures to increase active living (particularly active travel) are discussed in the next section.

Summary

Recreational activity

- Consistent associations have now been demonstrated in a number of countries between features of the external built environment and the likelihood of undertaking regular physical activity, as well as the relative prevalence of obesity and overweight.
- Since the majority of this work is based on US and Australian studies, there are very valid concerns about the transferability of these findings to a UK/Scottish context.
- Published reports in this area are characterised by increasingly sophisticated methods of enquiry, including natural experiments, longitudinal study designs and stratification by dominant preferences and behaviours.
- An increasing acknowledgement of the secondary role for physical inactivity, compared with excess energy intake, as a driver of the modern obesity epidemic, highlights the need to avoid reliance on activity measures alone (particularly recreational measures), as a means of tackling excess population weight gain.

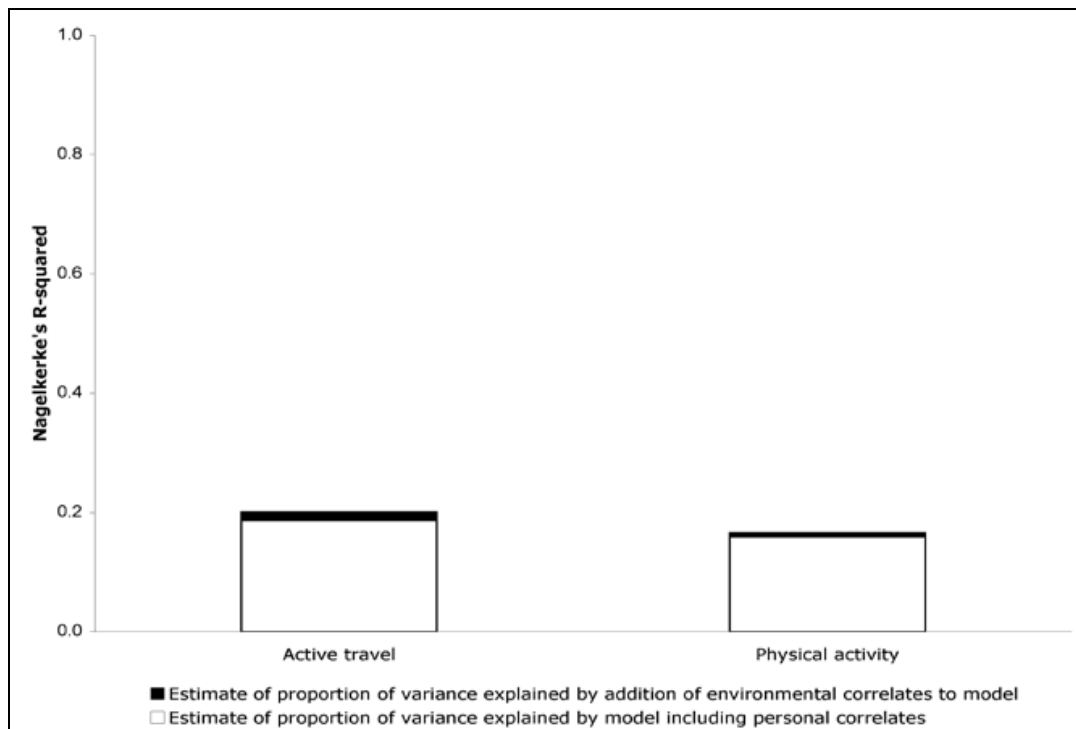
ii. Physical activity associated with 'active living'

One of the five key 'most promising policy response' options of the UK Government's Foresight Report was the recognition that there may be substantial opportunities for increasing physical activity levels across the whole population through subtle behaviour changes in everyday living, working and travelling. This rationale is underpinned by a number of characteristics of the current obesity epidemic, both in the UK and internationally: firstly, from an aetiological standpoint, physical activity levels in relation to leisure (while admittedly being largely based on self reporting), have been relatively stable in comparison to the declines associated with employment patterns and travel choices [73]. Secondly, major lifestyle changes to prevent or reduce excess weight are often not realistic for the majority of the population and crucially, even where there are initial health gains, they are unlikely to be sustainable, with most subjects regaining the weight lost over time [74]. Lastly, the mechanism of gradual weight gain over time is generally attributable to a very small daily excess, over many years, in energy intake over expenditure [20]. This situation has led a number of commentators to conclude that the prevention of further population level increases in obesity can most usefully be tackled by interventions which produce marginal rises in energy output (as well as marginal reductions in energy intake), thereby addressing the 'energy gap' at the root of weight accumulation [75]. Some of the more technologically sophisticated studies (which directly track energy expenditure levels), have highlighted that the magnitude of the energy gap is such that nothing other than substantial changes in intake and expenditure (e.g. decreased intake in the region of 400 kcal per day or daily moderately intense exercise of 110 minutes duration), would be sufficient to close the gap on surplus energy accumulation and prevent further weight gain [76].

As with leisure based physical activity, between country variations in baseline levels of active travel can cause problems when considering the transferability of policy and environmental interventions. International studies however can be extremely informative since they allow for meaningful comparisons between diverse aspects of urban design as potential determinants of activity levels. In one recently published Scottish investigation Ogilvie *et al* [77] examined correlates of active travel and physical activity using a 14-item neighbourhood rating scale and the internationally validated IPAQ¹² questionnaire [78]. Apart from access to local amenities, environmental characteristics proved to have a limited influence on active travel for this relatively deprived Glasgow population. The only other statistically significant environmental association was an inverse relationship between 'perception of traffic volume' and likelihood of physical activity. This apparently counterintuitive result has been reported by other authors and has been explained by the suggestion that more frequent cyclists are more conscious of traffic volumes [79]. Figure 3.5 (from Ogilvie *et al*), illustrates the estimated proportion of variance for both active travel and physical activity in general, explained by environmental correlates.

¹² International Physical Activity Questionnaire (IPAQ) <http://www.ipaq.ki.se/ipaq.htm>

Figure 3.5 Estimated proportions of variance in active travel and physical activity explained by personal and environmental characteristics



(Y-axis: Nagelkerke's R^2 is a modification of the Cox and Snell coefficient to transform the range to a 0–1 scale).

(Source: Ogilvie *et al* 2008 [77])

While Ogilvie's study was in a particularly deprived Glasgow population and was also obliged to disregard a substantial number of returned questionnaires (IPAQ methodology requires that one 'don't know' answer means that the whole return is void), the predominance of personal over environmental correlates was also seen in a San Francisco Bay study [80]. Using factor analysis to represent urban design and land use diversity dimensions, Cervero and Duncan found built environment factors to exert far weaker, though not inconsequential, influences on walking and bicycling than control variables such as demographics, household income and car access. The undisputed car dominance in this study, even for trips under one mile (60.7% by car and 34.3% walking), also highlights the true scale of the 'active travel' challenge, in the US at least.

Stafford *et al* also used sub-factor analysis to quantify the contributions of environmental and individual variables to both waist–hip ratio (WHR) and BMI [81]. Based on routine data from both the Scottish Health Survey and Health Survey for England, the only statistically valid associations for environmental characteristics were 'high-street facilities' (pharmacies, opticians, dentists and banks) associated with very marginal effects: (OR=0.96 for BMI¹³) and for 'neighbourhood disorder' (a composite variable of perceived neighbour trustworthiness, fear of walking alone after dark, amount of vandalism and litter) (OR=0.74 for 'sports participation rate'). The sports participation rate had only in turn a very minor influence on BMI (OR=0.96) and a negligible impact on WHR (OR=1.005). The equivalent odds ratios for each ten-year increase in age were 1.22 for BMI and 1.37 for WHR; for male gender 0.72 (BMI) and 0.89 (WHR) and for social class (based on occupation groups I to V), BMI (1.08) and WHR (1.06). The very marginal nature of all the modelled associations from the English and Scottish datasets, other than the influence of neighbourhood disorder on sports participation (OR=0.74), is not especially encouraging for the prospects of identifying promising interventions for promoting physical activity in a local/ community setting. A number of other countries, most notably those in northern Europe, do in fact have a considerably higher proportion of all journeys taken by bicycle (table 3.4) and the discrepancy has been the subject of a recent detailed investigation by Pucher and Buehler [82].

¹³ OR values from Stafford paper derived from standardised path coefficients using natural log transformation from values in paper (hence absence of confidence intervals).

Table 3.4 Transport mode split in urban areas.

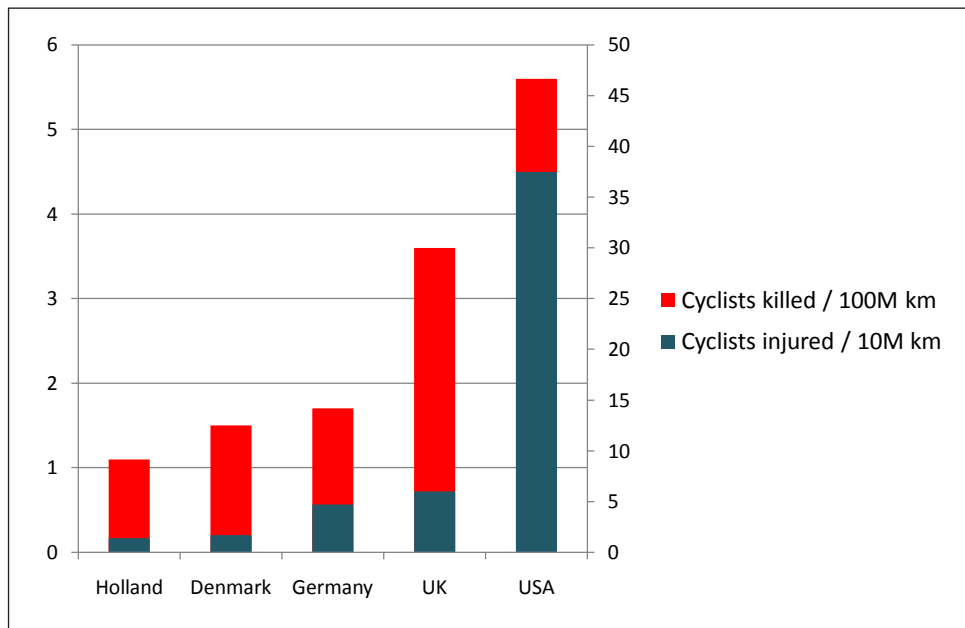
Country	Car	Public Transport	Cycling	Walking	Other
USA	84%	3%	1%	9%	2%
Canada	74%	14%	1%	10%	1%
UK	62%	14%	8%	12%	4%
France	54%	12%	4%	30%	0%
Germany	52%	11%	10%	27%	0%
Netherlands	44%	8%	27%	19%	1%
Denmark	42%	14%	20%	21%	3%
Austria	39%	13%	9%	31%	8%
Switzerland	38%	20%	10%	29%	3%
Sweden	36%	11%	10%	39%	4%

(Source: Pucher and Lefevre, 1996 [83])

Drawing also on Pucher's earlier review, which looked in detail at both walking and cycling in the Netherlands and Germany [84], the authors highlight the substantial gaps in active travel rates, particularly compared to the US, although the UK certainly has the lowest in Northern Europe. Even controlling for trip distance, Americans and Britons make just 1% of trips between 2.5 km and 4.4 km by bicycle, compared to much higher cycling rates for the same trip distance in Germany (11%), Denmark (24%) and the Netherlands (37%) [82]. Perhaps the most compelling aspect of these comparisons is that like the US and the UK, Germany and the Netherlands are both wealthy, technologically advanced capitalist democracies with high levels of car ownership. The addition of a historical perspective also shows quite clearly that Germany, Denmark and the Netherlands were all clearly originally heading in the same direction on transport infrastructure and preferences after the second world war, with cycling rates in all three plummeting between 1950 and the mid-1970s, as car ownership became widespread. At the beginning of this period cycling rates were actually higher in the UK than in Germany, at 15% of all trips. While British cycling continued on a downward trajectory after 1975, a massive reversal of transport and urban planning policies in the three comparison countries successfully revived bicycle travel to its current levels [84]. In simple terms, cycling has prospered in Germany, Denmark and the Netherlands precisely because these countries have 'given if not the red light, at least the amber warning light, to private cars'. While there was certainly no explicit obesity prevention objective over thirty years ago, simple quality of life, congestion and pollution considerations (possibly combined with the 1974 oil price hike), were sufficient to motivate decision makers to take steps to reduce private car dominance.

A detailed exposition of the multiple levers and policies used to engineer this active travel increase in our Northern European neighbours is outside the scope of this report, and in any case is expertly described in the two discursive reviews first-authored by Pucher [82, 84]. Suffice to say, it has been a concerted combination of infrastructure provision, integrated transport planning and disincentives for private cars which has helped bring about the higher active travel rates. Without doubt 'safety' and 'perception of safety' also seem to have substantial roles and can probably be regarded as the major mediator outcomes between built-environment interventions and increased participation in active travel. For the US in particular and to a slightly lesser extent in the UK, walking and cycling are comparatively dangerous travel options. Figure 3.6 shows cyclist deaths and serious injuries for the Netherlands, Denmark, Germany, the UK and the USA.

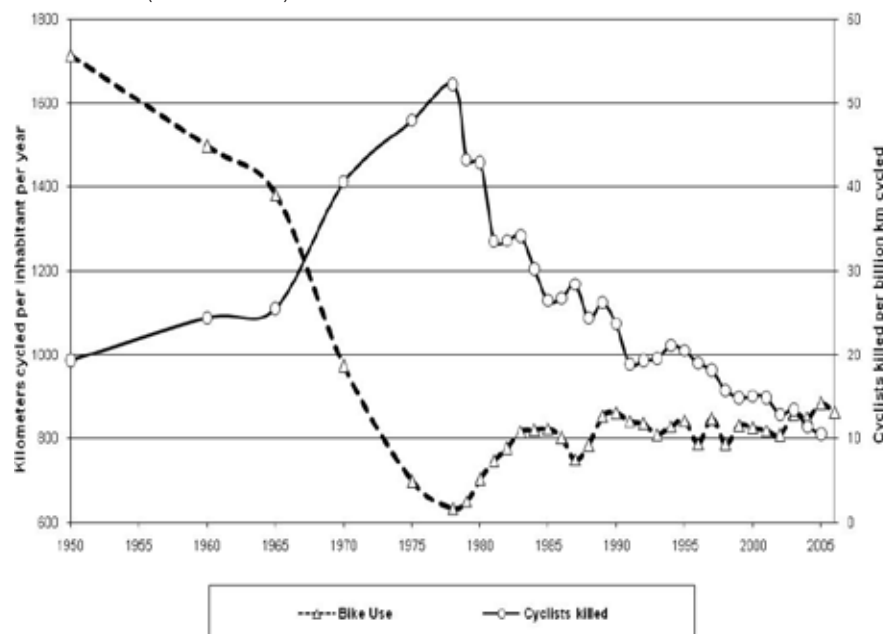
Figure 3.6 Fatality and injury rate by distance for five countries in 2004–2005 (right hand axis=USA only).



(Source: Pucher *et al* [82])

While the cyclist injury rate for the USA is by far the highest, it is based purely on police reports and is likely to represent a considerable underestimate (by a factor of at least ten in comparisons with CDC hospital surveillance figures [82]). For similar reasons, the official accident statistics of other countries are likely to be underestimates, although the rank-order and relative difference would be expected to mirror fatalities. The dramatic responsiveness of cycling rates to real risks is well illustrated by figure 3.7 from the Netherlands Ministry of Transport, showing the clear inverse relationship between trends over time (1950–2005) in cycling fatalities and readiness to travel by bike. This especially applies to the period 1978 to 1985, when cycling rates first rose in response to massive urban design changes.

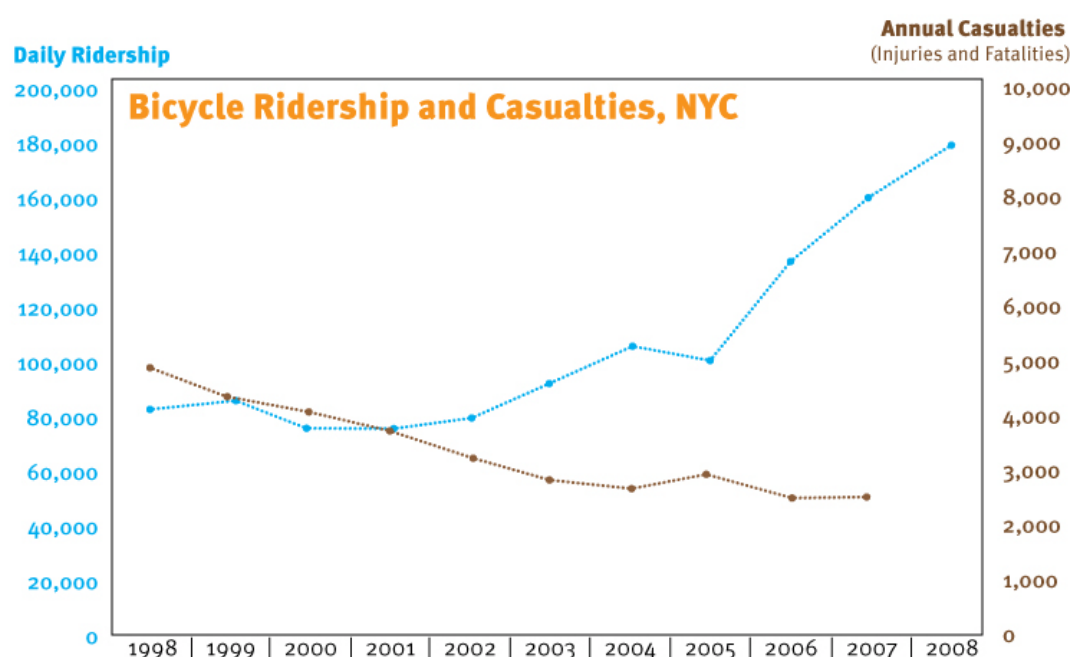
Figure 3.7 Inverse trends in cycling fatality rates and annual kilometres cycled per inhabitant in the Netherlands (1950–2005).



(Source: Netherlands Ministry of Transport, 2007; and Pucher [82])

Indeed, such is the current perceived levels of cycling safety in the Netherlands, that there is a high participation across all age-groups, including women and the elderly. Cyclists also rarely wear safety helmets or special visibility enhancements. Any reservation that this clear association between cycling safety and uptake is unique to the Netherlands ought to be dispelled by recent developments in New York, in the world's 'league leader' country for cycling deaths. A US news article published in June 2009¹⁴ reported that the number of cyclists had increased by more than a third in the previous four years to 185,000 daily commuters. This was attributed to a combination of infrastructure improvements and increased attention to cycling safety throughout the city. Figure 3.8 illustrates the increasing uptake in cycling in New York as casualty rates fall (although it was not clear from the source article how the estimated 'daily ridership' total had been estimated).

Figure 3.8 Estimated daily bike ridership and annual casualties in New York City 1998–2008



(Source: Transportation Alternatives, 2009¹⁴)

The overriding importance of making active travel a safe option has already been acknowledged in UK government guidance from the National Institute of Clinical Excellence (NICE), on promoting and creating environments to support physical activity¹⁵. In their recent review of the evidence, they identified three medium to high quality studies that supported traffic calming as a means of enabling children to benefit from outdoor play (see Appendix 2). They additionally found evidence from two included studies (one high quality and one low quality), to support a role for cycling infrastructure improvements in promoting higher rates of cycling and reductions in casualties. Drawing also on the conclusions of a recent expert review [85], they found sufficiently convincing evidence applicable to a UK setting, to recommend the following measures as a means of incentivising more active travel options:

- re-allocating road space to support physically active modes of transport (for example, widening pavements and introducing cycle lanes)
- restricting motor vehicle access (for example, by closing or narrowing roads to reduce capacity)
- introducing road user charging schemes
- introducing traffic calming schemes.

¹⁴ StreetBeat, 4 June 2009. Transportation Alternatives http://www.transalt.org/files/newsroom/streetbeat/2009/June/0604.html#safety_in_numbers

¹⁵ Promoting and Creating Built or Natural Environments that Encourage and Support Physical Activity: NICE Public Health Guidance 8. NICE; 2008. <http://guidance.nice.org.uk/PH8>

NICE's predecessor organisation, the Health Development Agency, had also commissioned a wide-ranging review entitled *Transport Interventions Promoting Safe Cycling and Walking* [86]. The initial briefing was two-fold namely: (i) what transport interventions are effective in increasing active travel?; and (ii) what transport interventions are effective in increasing the safety of walking and cycling?. The fact that the eventual title choice focuses principally on the safety aspect is probably a reflection of a safety engineering dominated literature, which tends to emphasise the safety outcomes of transport interventions, rather than 'modal switching' or the uptake of active travel. The authors also noted that while variables in the urban environment do influence walking and cycling, it remains unclear which characteristics of the built environment are the most important.

Car ownership and individual motivation levels certainly remain strong confounding factors in the relationship between travel choices and features of the built environment. On active travel specifically, the review level evidence was inconclusive on the effectiveness of engineering/built environment measures (such as traffic calming etc), in promoting a shift away from car use, but did find that these measures were effective in reducing accidents [86]. Combining these findings with the already established importance of safety, highlighted above, at least makes a circumstantial case for proposing that built environment improvements which improve active travel safety are a legitimate means of attempting to increase the uptake of walking and cycling, although proper evaluation of their health enhancing effects is still warranted.

Summary

Active travel

- Limited evidence for environmental influences on active travel is not particularly surprising in a UK setting, where baseline levels are low and largely confined to self selected population sub-groups.
- International comparisons with countries that have equally high levels of car ownership and similar climates, give grounds for optimism that active travel could be promoted by built-environment modifications, although significant infrastructural investment would be required.
- The finding that much of the existing evidence base relates to the capacity of built environment interventions to improve safety, should not be discouraging to policy makers, in the light of the clear importance of improved safety in encouraging wider participation in active travel.
- Although any direct impact of increased active travel on obesity has yet to be demonstrated, conservative estimates of general health benefits correspond with a high cost-effectiveness in the medium to long term (see section 5.4).

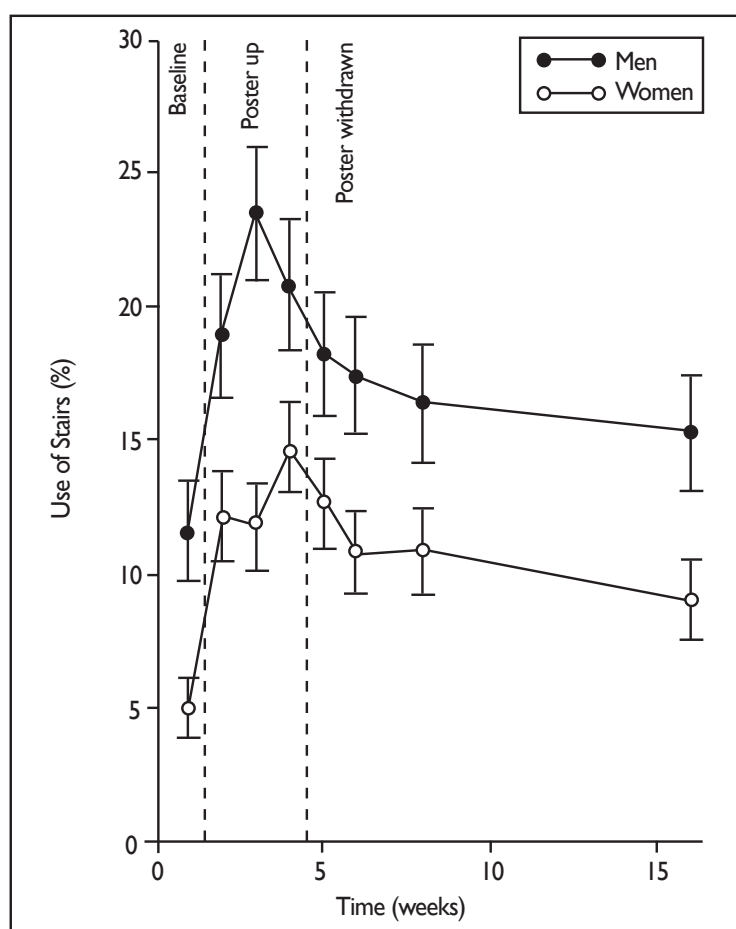
3.5 Physical activity interventions (micro-level)

i. Point of decision prompts

Physical surroundings which are relevant to micro-level interventions can be thought of as increasing in scale from firstly, the home or work setting; secondly, the intermediate-scale environment of publicly accessible facilities/buildings; and thirdly, the entire local community or immediate neighbourhood. All three of these levels have been established as having an impact or influence on levels of physical activity, including the use of specific adaptations, design features or awareness prompts. Awareness cues or 'point-of-decision prompts' (PODPs), represent the most straightforward and least costly of these adaptations to implement. Thus it is perhaps unsurprising that the greatest quantity of published evidence is related to PODPs. PODPs are defined as: 'motivational signs placed at or near stairwells or at the base of elevators or escalators to encourage individuals to increase stair use'[87]. Usefully, the CDC's Guide to Community Preventative Services, which is one of the most respected international review bodies for public health interventions, very recently updated their review of the effectiveness of PODPs to include a separate analysis on studies which had combined such prompts with other complementary environmental features [88]. The CDC task force were able, on the basis of 13 qualifying studies, to

recommend the use of PODPs on the basis of 'strong evidence of effectiveness in moderately increasing levels of physical activity, as measured by an increase in the percentage of people choosing to take the stairs rather than an elevator or escalator'. There was insufficient evidence however to recommend additional environmental enhancements (only two qualifying studies were identified). The review shows a wide range of effect sizes for the relative percentage change in the proportion of subjects making healthy activity choices (overall median = 50.0% increase, but with a huge intra-quartile interval 5.4 to 90.6) and includes one study carried out in a Glasgow underground station in Scotland [89]. Signs saying 'Stay Healthy, Save Time, Use the Stairs' were placed before station exits, where stairs (two flights of 15 steps) and escalators were adjacent (figure 3.9).

Figure 3.9 Pattern of stair use among men and women during 'stair sign' study, in Glasgow underground station (values are weekly sample percentages with 95% confidence intervals)



(Source: Blamey *et al*, 1995 [89])

The motivational signs significantly increased the percentage of men using the stairs from 12% at baseline to 21% throughout the duration of the intervention and the corresponding figures for women were 5% to 12%. Stair use decreased during the two weeks after the sign was removed but remained significantly higher than baseline after the full twelve weeks of follow up ($P=0.01$). The ongoing recidivist trend back to baseline on the other hand, is very evident from figure 3.9 (taken from the published report), and continues to be a concern with this type of study. The CDC review therefore highlights the need for ongoing research into which particular combinations of interventions might help sustain behaviour change, such that it becomes habitual.

ii. *Building design features*

As well as motivational posters, another type of intervention which has demonstrably increased stair use is structural alterations to buildings, in which for example the lift does not stop on all floors. More suited to a US employer setting, where it is not unusual for companies to occupy a number of floors in an office block, the specific example of the 'stair-skip' design [90] probably has limited relevance to the UK, but the principles and the process may have implications for modifications which have a similar objective (namely to encourage activity as part of daily routine). In an evaluation of the stair-skip design, Nicoll and Zimring exploited a natural experiment in which the idea was implemented in the California Department of Transport building in Los Angeles [90]. Described more as a 'push' strategy that 'mandates' physical activity through stair use by reducing access to elevators, the authors contrast the approach with more traditional 'pull' strategies such as PODPs described above. Since the building in question had two 'circulation cores' it was relatively straightforward to set up a real-time control in the other half of the building. The 'skip-stop' elevators only stopped at every third floor and were adjacent to an open staircase. While interpretation of the results is highly problematic due to a very low response rate (17.4%), the open skip-stop stair was used 33 times more than the enclosed fire stair in the comparison part of the building. The most illuminating finding related to the attitudes of study participants towards the 'skip-stop' stair, with the proportion expressing satisfaction with the arrangement increasing from 32.4% to 47.5% (299 participants). This positive change in attitude has parallels with the findings of other structural and fiscal interventions, most notably the London congestion charge, where initial resistance declines when the benefits become apparent¹⁶.

Summary

Physical surroundings

- Simple motivational signs can be an effective means of increasing physical activity in public settings such as shops and public transport hubs.
- As in other areas of health promotion, the best means of sustaining any positive behaviour change continues to be an area of considerable uncertainty and is likely to remain an active research priority for the foreseeable future.
- Structural interventions such as engineered 'stair-skip' measures in buildings can also increase routine daily physical activity and the initial levels of employee/public resistance to these interventions appear to decline over time.

¹⁶ London's Congestion Charge is a success. Institute of Environmental Management and Assessment News. Oct. 2003. <http://www.iema.net/news/envnews?aid=4291>

4

Chapter 4 – Interventions to the economic environment

4.1 Introduction

‘Sugar, rum and tobacco are commodities which are nowhere necessities of life, which are become objects of almost universal consumption, and which are therefore extremely proper subjects of taxation.’

Adam Smith, The Wealth of Nations, 1776.

Recent successes in the developed world with tobacco control, using a combination of sales taxes and environmental legislation, have stimulated the debate on whether a similar approach might be possible with obesity promoting foodstuffs [91]. As the introductory quote illustrates, taxation is certainly by no means a novel idea and there is much recent epidemiological evidence to suggest that it could be a useful and effective means of addressing the relentless population rises in obesity and overweight in Scotland and the UK. Maintaining the ANGELO framework structure, the following section on the economic domain will first consider nationally imposed fiscal measures under macro-level interventions and local/institutional/site specific interventions under the micro-level category. The quality of evidence in both of these areas has recently advanced considerably, although the implementation of economic levers and incentives will always present significant evaluation challenges and the potential for unintended consequences [92]. Research findings on fiscal measures to promote/incentivise physical activity, although they are generally restricted to particular risk groups (such as the elderly), are also briefly reviewed at the end of this section.

4.2 Nutrition interventions (macro-level)

Sugar sweetened beverages are drinks which contain naturally derived caloric sweeteners such as sucrose (table sugar), high fructose corn syrup, or fruit juice concentrates. Although the different types of drink generally contain comparable calories gram for gram, they do have differences in their respective metabolic profiles, which are outside the scope of this report. The past 30 years has seen dramatic increases in sugared beverage consumption in many parts of the world, most notably in the US, where per capita intake doubled across all age groups between 1977 and 2002 [93]. Although most of the evidence for an association between soft drinks and weight gain is observational in nature, there have also been short term clinical trials, which have helped progress understanding about the way in which sugared beverage consumption may be linked to adiposity. Indeed the extent and volume of circumstantial, longitudinal and experimental evidence strongly linking this type of drink to the current obesity pandemic, makes a compelling case in the opinion of some expert commentators for some form of government intervention [93]. A three-level rationale has recently been put forward by Kim and colleagues in support of a dedicated tax on soft drinks/snack food items [94], the principal components of which are:

- i. A growing body of evidence, including prospective studies, linking an increased consumption of high-energy/low-nutrient food and drink with weight gain and other adverse health effects
- ii. Extensive confirmation from around the world that sugared beverage purchasing by consumers is strongly sensitive to price
- iii. The duty of government to protect consumers where massive levels of investment in the advertising and promotion of unhealthy food and drink, make it difficult for the public to take properly informed decisions about health risks.

i. Effects of consumption on health

Since 40 states in the US now impose some form of sales tax on at least one of sugared drinks, sweets or snack items [95], several authors have looked at between-state variations in the patterns of consumption and correlations with crude health indicators such as BMI. Having been introduced without any explicit health objective, these reports are more ‘opportunistic observations’ than ‘natural experiments’, but they nevertheless give some grounds for optimism about the potential benefits of fiscally mediated reductions in consumption. Kim and Kawachi for instance were able to demonstrate strong positive associations between the presence of state level taxation on soft drinks (and snack foods), between 1991 and 1998 and relative changes in obesity prevalence [94] (table 4.1). Their most striking result is that seen for the small number of states with a repealed tax, which were over 13 times more likely than states with a tax (OR=13.3; 95% CI: 0.7 to 262.0) to experience a high relative increase (top 25%) in obesity prevalence, during the seven year follow up. The wide confidence interval and the borderline nature of the statistical result (P not reaching < 0.05 for 95% significance), is due to the small number of states in this category, and does not negate the magnitude of the result. Of course the interpretation of ecological studies such as these is always intrinsically hazardous and other measures favourable to the food industry cannot be ruled out in states without a tax, or in those where it has been repealed.

Table 4.1 USA state-level associations between presence of taxes on soft drinks or snack foods and relative increases in obesity prevalence, 1991–1998 (CI=confidence interval)

	Total no of states	No of states $\geq 75^{\text{th}}$ ile ^a	Multivariate-adjusted odds ratio ^b (95% CI)	p value
With a tax ^c	14	1	1.0	—
Without a tax	23	7	4.2 (0.4–48.3)	0.25
Repealed tax	6	3	13.3 (0.7–262.0)	0.09
With a 5% tax ^c	10	1	1.0	—
Without any tax	33	10	3.0 (0.3–33.1)	0.38

(Source: Kim and Kawachi, 2006 [94])

^a $\geq 75^{\text{th}}$ percentile in relative increase in state obesity prevalence between 1991 and 1998.

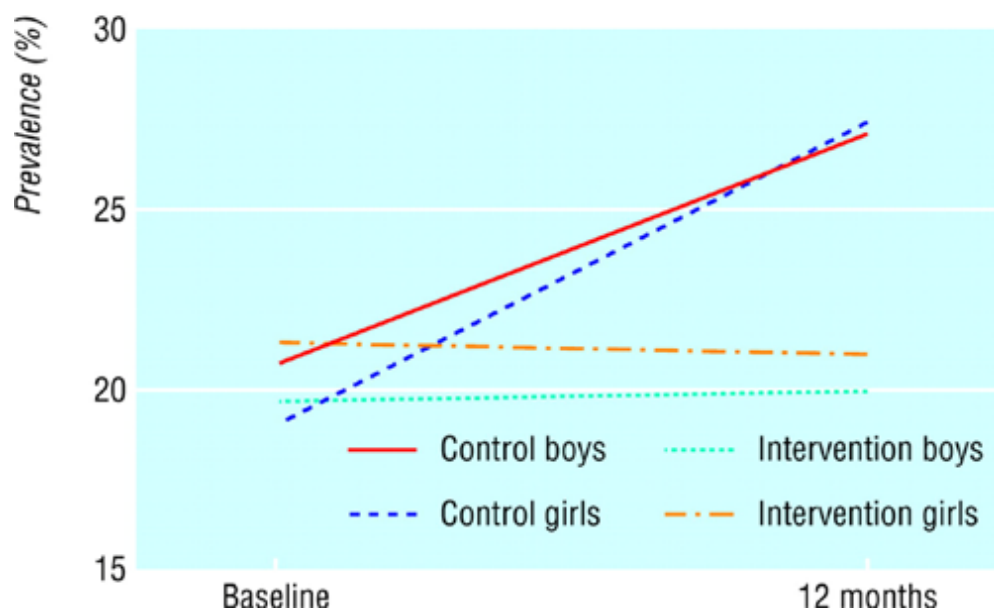
^b Odds ratio for being $\geq 75^{\text{th}}$ percentile, adjusted for state median age, mean income, and % black (all from 1990 USA census), and political party carrying the state in the 1992 USA presidential election (no odds ratio statistically significant at 0.05 level).

^c Reference group.

A series of longitudinal studies have also shown clear associations between sugar sweetened soft drink (SSSD) consumption and obesity levels. In one two term follow up of 548 children in Massachusetts for example, for each additional daily consumed unit of SSSD, the risk of being obese increased by 60%, after controlling for all other dietary, demographic and other lifestyle factors [96]. A meta-analysis published in 2007, found that the intake of SSSDs is associated with higher body weight, poorer nutrition, displacement of healthier beverages and increased risks of clinical obesity and diabetes [97]. The overall effect size from the longitudinal studies in this review was 0.09 ($P < 0.001$) for the effect on BMI of a unit change in SSSD intake.

An educational intervention trial focusing on SSSDs used a randomised cluster design in six primary schools in south west England [98]. Marginal reductions were reported for the intervention group in SSSD consumption of 0.6 (250 ml) glasses over a three day period, compared with a rise in consumption of 0.2 glasses for the control group. Figure 4.1 shows the differences in the relative prevalence of obesity and overweight between the intervention (0.2% decrease) and control groups (7.5% increase) over the course of the 12 month intervention (mean difference: 7.7%; 95% CI: 2.2% to 13.1%). A follow up study carried out two years after the end of the intervention [99] showed that while the prevalence of overweight was still higher in the control group (30.2% vs 25.6%), the difference was no longer statistically significant (95% confidence interval: -4.3% to 10.6%; $P = 0.28$).

Figure 4.1 Mean change in prevalence of overweight and obese children from baseline to follow up at 12 months according to clusters. Intervention groups received a focused educational nutrition programme aimed at reducing sugar sweetened soft drinks in a school based randomised cluster design.



(Source: James *et al*, 2004 [98])

The notable rises in obesity prevalence in the control arms of the study, together with a number of methodological concerns (e.g. a reliance on accurate diary completion by young children), have led some commentators to recommend a cautious interpretation of the results (see BMJ responses to James *et al* [98]). A follow up study carried out two years after the end of the intervention [99] showed that while the prevalence of overweight was still higher in the control group (30.2% vs 25.6%), the difference was no longer statistically significant (95% CI: -4.3% to 10.6%; $P = 0.28$). In a 'substitution' study with US adolescents who had higher baseline levels of sugared beverage consumption than the James trial, the net difference in BMI was not significant overall, but crucially there was a real difference for those in the upper BMI baseline tertile (specifically, BMI change differed significantly between the intervention [-0.63

+/- 0.23 kg/m²] and control [+0.12 +/- 0.26 kg/m²] groups for those with a baseline BMI \geq 25.6 kg/m², resulting in a net effect of -0.75 +/- 0.34 kg/m²) [100]. Furthermore, the interaction between weight change and baseline BMI was not attributable to baseline consumption of sugared sweetend beverages. Characterised by a diverse cohort and a reassuringly high retention rate of 83%, this USA study by Ebbeling and colleagues holds out the serious prospect of an intervention that by itself targets those most at risk, possibly involving underlying increased susceptibilities, unrelated to baseline consumption.

Since the extrapolation of findings from school and adolescent trials to working age adults is not without risks, it is worth comparing these results with those obtained for SSSD consumption in one of the largest ongoing US cohort studies [101]. The Nurses Health Study II is a large prospective cohort of 116,671 female US nurses aged 24 to 44 years at study initiation in 1989, and who are followed up by biennial mailed questionnaires. The questionnaire includes multiple lifestyle indicators including dietary intake, physical activity and health status and generally has a follow up in excess of 90% for each 2-year period. A nested cohort of 51,603 women for whom complete dietary and bodyweight information were available for 1991, 1995 and 1999 were analysed for the incidence of type II diabetes according to patterns of SSSD consumption. The study's most elegant feature is the analysis of subgroup effects according to changes in consumption habits. Weight gain, for instance, over a 4 year period was highest among women who increased their SSSD consumption from 1 or fewer drinks per week to 1 or more drinks per day (multivariate-adjusted means, 4.69 kg for 1991 to 1995 and 4.20 kg for 1995 to 1999) and was smallest among women who decreased their intake (1.34 and 0.15 kg for the two periods, respectively) after adjusting for lifestyle and dietary confounders. The authors propose that the excessive calories and large amounts of rapidly absorbable sugars could explain the larger weight gain and increased risk of type II diabetes, associated with the higher consumption of SSSDs. Nissinen *et al* also reported a direct correlation between an increase in the consumption of sugar sweetened drinks from childhood to adulthood and adult BMI¹⁷ (OR for being overweight = 1.90; 95% CI: 1.38 to 2.61) in young Finnish women, but not in men [102].

ii. Price elasticity

The growing case, in many countries, for supplementary taxes on sugared beverages on health grounds, has prompted researchers to examine how responsive purchase (i.e. presumed consumption) might be, in relation to price changes. The economic term that describes consumer sensitivity to the price of a particular product is 'price elasticity', which is a dimensionless construct defined as the percentage change in purchased quantity (i.e. demand) associated with a 1% change in price [103]. Price elasticity is determined by a multitude of factors including household income, availability of substitutes, consumer preferences etc. When the relative change in purchased quantity is below the relative change in price, demand is said to be 'inelastic' (numerically expressed as a value below 1.0). Changes in demand greater than the relative price change have a value greater than 1.0 and are called 'elastic'. The results of a recent comprehensive review of 160 studies on the relative price elasticities of major foodstuffs are shown in table 4.2. Price elasticities for foods and non-alcoholic beverages ranged from 0.27 to 0.81 (absolute values) with soft drinks (0.79; 95% CI: 0.33 to 1.24) being second only to 'food away from home' (0.81; 95% CI: 0.23 to 1.76) for the highest relative price elasticity of the items included.

¹⁷ Effect size in Nissinen *et al*: $b=0.45$; $p=0.0001$ i.e. BMI increased by 0.45 kg/m² for every 10 unit increase in soft drink consumption per month.

Table 4.2 US price elasticity estimates, by food and beverage category from 1938–2007

Food / Beverage Category	Absolute Value of Mean Price Elasticity (95% CI) #	Range	No. of Estimates
Food away from home	0.81 (0.56, 1.07)	0.23 - 1.76	13
Soft drinks	0.79 (0.33, 1.24)	0.13 - 3.18	14
Juice	0.76 (0.55, 0.98)	0.33 - 1.77	14
Beef	0.75 (0.67, 0.83)	0.29 - 1.42	51
Pork	0.72 (0.66, 0.78)	0.17 - 1.23	49
Fruit	0.70 (0.41, 0.98)	0.16 - 3.02	20
Poultry	0.68 (0.44, 0.92)	0.16 - 2.72	23
Dairy	0.65 (0.46, 0.84)	0.19 - 1.16	13
Cereals	0.60 (0.43, 0.77)	0.07 - 1.67	24
Milk	0.59 (0.40, 0.79)	0.02 - 1.68	26
Vegetables	0.58 (0.44, 0.71)	0.21 - 1.11	20
Fish	0.50 (0.30, 0.69)	0.05 - 1.41	18
Fats/Oils	0.48 (0.29, 0.66)	0.14 - 1.00	13
Cheese	0.44 (0.25, 0.63)	0.01 - 1.95	20
Sweets/ Sugars	0.34 (0.14, 0.53)	0.05 - 1.00	13
Eggs	0.27 (0.08, 0.45)	0.06 - 1.28	14
# Note: Values were calculated based on the 160 studies reviewed			

(Source: Andreyeva et al 2010 [103])

From a public health perspective of course, a relatively high elasticity for a particular food item is good news if price incentives are to be used to influence demand. The above results suggest that a 10% tax on soft drinks could lead to an 8% to 10% reduction in purchases of these items. On this basis, sugar sweetened beverages would make ideal candidates for targeted taxation. There is also evidence to suggest that the price disincentives for soft drinks and unhealthy snack foods are more effective in those who already are, or most at risk of becoming, obese [104]. Sturm and Datar for instance found that children from more economically deprived backgrounds and those identified as being at risk of becoming overweight or obese, were roughly 50% and 39%, respectively, more price sensitive compared with their non-poor and not-at-risk counterparts [105]. Higher fast food price elasticities have also been reported for adults at the upper end of the weight distribution spectrum [106].

iii. Economic imbalance

The declining costs in the real price of food, and the relatively lower prices of energy dense foods in particular, are widely held as a key driver of the current obesity epidemic, based on the substantial historical reductions in the cost of consuming a calorie [107]. Clearly if a large proportion of the population is over consuming energy dense snacks and high calorie drinks to the detriment of their ideal bodyweight and health status, they are not making optimal decisions for their health, even if their decisions are consistent with other perceived priorities. Transactions which harbour such a notable imbalance in the knowledge of benefits and harms, are sometimes referred to as examples of ‘market failure’, since the

best interests of all parties is evidently not being served. In the opinion of economist John Cawley, market failure represents the only legitimate economic basis for government imposed regulation [108]. While many who work in preventative health might consider that public health gain should be the guiding principle in decision making, the economic rationale also needs to be kept in mind since that can often be the starting point for the majority of elected officials and policy makers. The third principle of Kim's original framework for justifying fiscal interventions, namely that government should seek to protect consumers, where massive investment in the promotion of unhealthy products makes it difficult for them to take properly informed decisions, could yet therefore be the most persuasive.

As a means of trying to influence food decisions to be more optimal, in terms of consumer health, price incentives have a very real advantage over more information based measures such as food labelling, in that they are structural and do not rely on an individual consumer's imperfect knowledge to make good choices [94]. Of course, price incentives are already much used in food marketing and are almost always aimed at encouraging higher consumption (e.g. buy one get one free, kingsize/mega meal deals). Cheap, mass-produced food and soft drinks are highly profitable industries, but their real costs in health terms are usually deferred and fall on wider society, including publicly funded healthcare systems. In this context, government imposed structural interventions such as sales taxes on sugared beverages, are a very rational means of redress, particularly since those who are the most price sensitive tend to be groups who are most at risk or least empowered to make good informed choices (e.g. the young and the relatively socioeconomically deprived). Powell and Chaloupka's recent excellent review of the prospects for such measures [104], concluded that non trivial pricing interventions have a real potential to realise measurable effects on population level weight outcomes. While the balance of the evidence at the moment suggests that any resulting behaviour change at the individual level would be marginal at best, the proposal is easily recognisable as a classic prevention paradox [109], with significant potential for population and societal level gains, in spite of small effects at the individual level. In addition, small decreases in daily or weekly energy intake are themselves recognised as an effective means of achieving favourable changes in body weight and reduced risks from obesity related diseases such as diabetes [20]. Of course the extent to which governments and regulatory bodies might be inclined to adopt such structural fiscal measures will necessarily be related to their perspective on deciding for consumers what their priorities should be. Chapter 8 of this report introduces a framework which stakeholders and policy makers could use to explore some of the more involved considerations around implementation, such as ethics and sustainability.

4.3 Nutrition Interventions (micro-level)

Possibly the most conclusive evidence of the capacity of workplace interventions to impact on types of food consumed comes from French *et al*'s multiple vending machine intervention based in four large bus garages, which has strong similarities to the groups' previous 'changing individual's purchase of snacks' or 'CHIPS' study on college campus sites [110]. Increases in the availability of healthy snacks by 50%, combined with average price reductions of 31%, resulted in 10% to 42% higher sales of these items [111] across the garages. As the authors themselves point out, the reliance on aggregate data was a major limitation of the study, meaning that it was not possible to know if individuals changed their vending machine use frequency or their choices. Indeed the lack of any significant differences between the intervention and control groups in the self reporting survey arm of the evaluation, serves to raise significant questions over the interpretation of the results. The picture is further complicated by the use of the machines not being restricted to bus drivers but available to all garage staff. The increased purchases could simply be a reflection of more attractive pricing to all garage users, or even existing users making multiple purchases which would certainly explain the magnitude of the increases.

A recently published elaborate randomised trial from New Zealand by Ni Mhurchu and colleagues, impressively demonstrates how the same price incentive principles that were successfully employed in workplace environments can be transferred to the more general food retailing set up of the supermarket chain [112]. The trial involved eight supermarkets and 1,104 shoppers who were randomly assigned to one of four interventions (12.5% discounts on healthier foods; tailored nutrition advice only; 12.5% discount plus nutrition advice and fourthly, a control arm with no intervention), delivered over 6 months. Although there was no significant difference in the primary outcome of amount of saturated fat purchased

at 6 months (or other nutrients in the assessment), those assigned to receive price discounts on healthier foods bought 11% more of these foods at 6 months (mean difference=0.79 kg/wk; 95% CI: 0.43 to 1.16; $P < 0.001$) and 5% more at 12 months (mean difference=0.38 kg/wk; 95% CI: 0.01 to 0.76; $P=0.045$). The complicated design of the intervention tends to support the authors' views that these are likely to be conservative estimates of the potential for improved purchasing, since exploiting the discounts relied on shoppers consulting a large list of eligible products sent to them by post. The design also necessitated the use by shoppers of hand held scanners which indigenous New Zealanders in particular, did not particularly feel comfortable with (Ni Mhurchu, personal communication). The significance of the 12.5% discount is that this corresponds to the current rate of sales tax in New Zealand, leading to the potential recommendation of removing this charge from fruit and vegetables as a means of improving consumption. The resultant 11% increase in purchasing at 6 months corresponds to an almost unitary price elasticity of 1.0 and is higher than any of the other items given in table 4.2.

Summary

Economic interventions – nutrition (macro and micro)

- Substantial increases in the worldwide consumption of high energy foods and sugared beverages have paralleled the current international obesity epidemic.
- Evidence from a wide variety of studies, including randomised trials, have shown strong associations between population level weight gain and the consumption of high energy foods and drinks.
- Although there remain some methodological concerns around food diary reporting and long term sustainability, restriction and substitution studies in children and adolescents have reported real differences in weight outcomes, with those who are most overweight seeing the greatest benefits.
- Soft drinks have a relatively high 'price elasticity', in that their purchase by consumers, particularly those at risk from obesity, or from more economically disadvantaged groups, is more price sensitive compared with other types of foods.
- Soft drink taxation fulfils all the criteria for governments to address a 'market failure' and reap significant public health benefits.
- Consumer purchasing levels of healthy foods such as fruit and vegetables can be enhanced by modest price reductions.

4.4 Physical activity interventions (macro-level)

At the macro-economic level, the case for infrastructure investments to support the safety and convenience of active modes of travel has been covered in some detail previously in section 3.4. Chapter 6 further explores how mass media communication and large scale public participation events can help change attitudes and encourage higher participation rates in walking and cycling. Of course, as was also highlighted in chapter 3, an increased provision of public transport can also encourage the use of these more active forms of travel. By the same token, increasing the costs of private car transport (e.g. parking charges etc), is likely to be a major component of successful active travel promotion in northern European countries (see section 3.4).

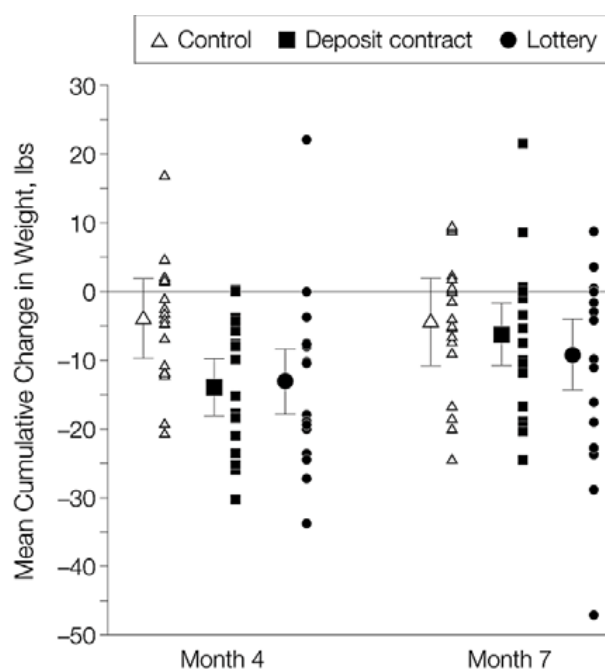
4.5 Physical activity interventions (micro-level)

The difficulty in changing the sedentary habits of persons who are relatively inactive, both at the individual and population level, often relates to the fact that exercise is not seen, at least initially, as intrinsically rewarding enough to make it an attractive option. One obvious and immediate way of addressing the apparent 'lack of reward' is to provide financial incentives for the target group to undertake the new behaviour. As discussed in the preceding section, financial disincentives in the form of additional taxes on tobacco and alcohol are a proven means of reducing consumption, but the effect of positive financial incentives remains less clear [55]. None of the 17 trials, in a recent Cochrane Review of the effect of

incentives on smoking cessation for example, showed higher quit-rates at six months, when incentives were used [113]. Two recent randomised trials looked at financial incentives for obesity preventative measures, the first of which was focused on increasing physical activity in sedentary older adults [114], and in the second, incentives were used as a means of helping obese adults achieve weight loss [115]. Strictly speaking, weight loss in obese adults could more accurately be considered as treatment rather than prevention, although any effect on established elevated BMI in this group would certainly be of significant interest to those with an interest in obesity prevention. Although the activity promotion trial was restricted to a very short follow-up period of 4 weeks and the convenience sample method raises concerns over generalisability, the intervention group logged an average of 4.1 hours per week aerobic activity (pedometer measured), as opposed to the 2.3 hours per week in the control group.

In the weight loss target study, reported by Volpp and colleagues [115], there were two incentivised groups: one group received lottery tickets when they reached monthly weight loss targets, while the other received supplementary payments after themselves making a small financial commitment at the outset (deposit contract group). About half of the subjects in both control groups met the 16lb weight loss target at 4 months, compared with only around 1-in-10 of the control group. Both intervention groups had regained weight at the end of the intervention, although at the 7 month follow up they were still significantly lighter on average than at the start of the study (figure 4.3). Since weight re-gain is an almost universal feature of successful initial weight reduction programmes, the results in this case do raise questions over how long participants would need to be 'incentivised' to maintain a healthy weight.

Figure 4.2 Weight loss from enrolment through intervention and 7-month follow up [115]



(Source: Volpp *et al* 2008 [115])

Summary

Financial incentives – physical activity

- The evidence around financial incentive schemes and physical activity is largely restricted to particular population subgroups, such as older adults and is difficult to separate from weight loss interventions.
- As with incentive work in other areas, long term behaviour change remains elusive and the sustainability of any benefits uncertain.

Chapter 5 – Interventions in the legislative environment

5.1 Introduction

The original ANGELO framework for prioritising obesity interventions defines the legislative (policy) environment as ‘encompassing the sum total of rules and regulations which deal with all aspects of food and physical activity’ [13]. A recent Canadian systematic review which also used the ANGELO categorisation framework was not able to identify any macro-level studies in the legislative domain [18]. This is likely to be more a reflection of the dearth of publishable evaluations meeting peer review quality criteria, rather than any absence of ideas or motivation by governments to implement solutions to rising population levels of overweight and obesity. Indeed the UK Government’s Healthy Weight, Healthy Lives (HWHL) document¹⁸ can be considered to have genuinely taken up the challenge set out in the Foresight Report and presents a cross-government strategy for England with four major priority areas for action (as chapter headings):

1. Helping people make healthier choices
2. Creating an environment that promotes healthy weight
3. Effective services for those at risk
4. Strengthening delivery (including surveillance).

Although the strategy has a strong child focus, the chapter on creating an environment that promotes healthy weight touches on many of the same issues as this report (e.g. food labelling at point of sale, covered in section 5.2 and increasing opportunities for daily activity discussed in detail in section 3.3). There is some preliminary evidence also to suggest that the HWHL programme may be having a beneficial impact, although the authors of a one year evaluation concede that it is early days and some apparent levelling off in the population prevalence of obesity gives no room for complacency¹⁹. The Swedish Ministry of Health also recently set out a comprehensive set of costed policy proposals across all sectors of government, aimed at tackling obesity [26], although there have as yet been no published updates on implementation or evaluation at the time of writing. A cross-government strategy for Scotland has also been published earlier this year. Entitled the Route Map towards Healthy Weight²⁰, the strategy adopted takes a lead from the Foresight Report and specifically focuses on obesity prevention. Both the Foresight Report and the Route Map are discussed in more detail in chapter 7.

The evolution of governments’ perceptions of the obesity epidemic, away from what was initially a lifestyle issue, towards its later recognition as a public health problem with strong cultural and economic drivers, had begun to influence the policy planning landscape around obesity prevention. Crucially from a legislative perspective, once obesity is recognised as a public health threat, it becomes legitimate to consider regulatory measures that may impact on the lives of private citizens, in an analogous manner to the way that the law is used for

¹⁸ Healthy Weight, Healthy Lives: A Cross Government Strategy for England, Dept of Health; 2009: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_082378

¹⁹ Healthy Weight, Healthy Lives: One Year On, Dept of Health; 2009: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH_097523

²⁰ Preventing Overweight and Obesity in Scotland: A Route Map towards Healthy Weight. The Scottish Government; 2010. <http://www.scotland.gov.uk/Publications/2010/02/17140721/>

the control of communicable disease and recent restrictions on second hand smoking in public places are a related example. Outright sanctions on behaviour are not feasible of course with either diet or physical activity, so legislative interventions in the case of obesity prevention need to be directed at environmental and structural enablers, such as financial incentives and the improved availability of healthier alternatives combined with targeted information approaches.

5.2 Nutrition intervention (macro-level)

At the macro-level of influence, the legislative environment concerning food refers to government food and nutrition policies, regulations and laws, and food industry practices and standards. For the developed western world at least, it is becoming increasingly accepted that legislation has a role to play in tackling obesogenic aspects of the nutrition environment [116]. Legal sanctions can potentially be used to control commercial food activities, to modify physical and economic factors (as described in sections 3 and 4), to regulate media practices (discussed in section 6) and to support informed consent by requiring the provision of information. The four macro-level legislative interventions which have attracted the most attention and for which there is some evidence around their potential effectiveness are:

- (i) trade tariffs/restrictions on specific food items or ingredients
- (ii) food labelling regulations
- (iii) industrial and agricultural policy frameworks
- (iv) food marketing and advertising (discussed in chapter 6).

i. Trade tariffs/restrictions on specific food items or ingredients

The potential for pricing controls as a means of influencing purchasing patterns has already been explored in relation to sugared beverages (section 4). For countries with the capability and willingness to make use of them, trade tariffs and restrictions could form the basis of a much broader, proactive approach to improve population diets. In principle for example, trade restrictions could be used to reduce the amount imported, or increase the quality of particular foodstuffs, depending on their relative 'obesogenicity'. In the light of French and colleagues' vending-machine studies discussed in chapter 4, there is also the possibility of reduced import tariffs for healthier foods, although to date this has not been implemented in any known jurisdiction [117]. One of the most notable examples of where trade regulations have recently been used to try and reduce supply at source is the attempt by the Pacific Island of Fiji to ban a particular type of meat import (mutton flaps). With over 60% of the adult population either overweight or obese, Fiji is typical among Pacific Island communities in having a major problem with childhood and adult obesity, as well as epidemic level diabetes [118] and poor diet is acknowledged to be an important part of the explanation. Since the Pacific islands now import most of their food, controlling what is available should in principle be straightforward and cheap fatty meats from New Zealand and Australia were an identifiable contribution to the excessively high fat diet of Fijians. An attempt to ban imported mutton flaps (see figure 5.1) in 2000 using a prohibition order under Fair Trade legislation, has only been partially effective, since whole carcasses can still be imported giving importers another route of entry. The measure was also challenged as an unfair trade restriction since other similarly high fat meat imports were not treated similarly. The case illustrates the complexity of using trade restrictions to control food products. While the World Trade Organisation's GATT²¹ provisions allow trade measures to be adopted that are: 'necessary to protect human/animal health', any such proposed new measure must yet fulfil what is essentially a very onerous two stage test, in which the trade restricting country must be able to demonstrate that:

1. The health measure is both effective and that no less restrictive trade measure(s) could be used to achieve the same public health purpose
2. The proposal does not constitute a 'disguised restriction' on international trade or 'arbitrary or unjustifiable discrimination'.

²¹ General Agreement on Tariffs and Trade. World Trade Organization; 1994 http://www.wto.org/english/tratop_e/gatt_e/gatt_e.htm

Figure 5.1 Mutton flaps which Fiji attempted to ban as an import



(Source: Book front cover image: Deborah Gewertz and Frederick Errington, *Cheap Meat: Flap Food Nations in the Pacific Islands*. ©2010 by the Regents of the University of California. Published by the University of California Press [photo courtesy of C. Keleba (ckeleba@yahoo.com.au)].

While the application of trade agreements to health regulation can be complex and challenging, as discovered in Fiji, there have been more successful strategies in other parts of the world. The West African state of Ghana for instance, has implemented an effective ban on fatty meat imports by setting nutrient composition thresholds for beef, pork and mutton (maximum fat contents of 25%, 42% and 35% respectively). While the US Government initially raised an objection over this trade measure, the non-profit CSPI (Center for Science in the Public Interest) has taken the position that Ghana's actions constitute 'a legitimate attempt to protect human health' [119]. Although there are currently UK restrictions on the minimum meat content of commercial food products, these originate in the main from trade description requirements, and are not generally informed by health considerations. Since meat products represent one of the largest sources of dietary fats (particularly saturated fats), it makes sense to consider thresholds for fat content on health grounds.

Although the implementation of any import restrictions in this country would almost certainly need full UK integration beyond Scotland as well as EU trade clearance, the imposition of an effective 'fatty meat' ban in a relatively impoverished West African state such as Ghana, at least offers an example of what might be possible. Closer to home, Denmark implemented a ban on trans-fats (fats and oils which have been chemically processed to increase their hardness and shelf life) in 2003²². While these fats are not necessarily proven to be more obesogenic than natural saturated fats, there is now a strong scientific consensus that they are potent promoters of cardiovascular disease to the extent that there may be no safe minimum threshold for consumption [120]. While there was initially a great deal of opposition as food producers experimented with alternatives, these problems have largely been resolved and there is already preliminary evidence (to date not scientifically verified) that the ban has been associated with a reduction in heart disease mortality²³. Crucially, Denmark's actions also demonstrate that there is nothing in EU law to stop other EU countries (including the UK), from undertaking similar measures. The full economic implications of any such bans or food quality thresholds, such as the Ghanaian restrictions, would of course need to be carefully considered and domestic meat sources of poor quality subjected to similar restrictions.

²² Denmark's trans fat law. Executive Order No 160 of 11 March 2003 on the Content of Trans Fatty Acids in Oils and Fats etc, (English Translation) <http://www.tfx.org.uk/page116.html>

²³ Trans Fat Restriction in Denmark Offers Success Story for Similar Initiative in New York City. <http://www.naturalnews.com/020788.html>

ii. Food labelling regulations

The complexities involved in restricting less healthy foods at source, combined with a general reluctance to impinge on consumer choice in western developed economies, means that the majority of legislative control measures have been around obligations to provide information on the nutritional quality of foods. Pre-packaged foods in particular generally contain high levels of sugar, saturated fat, and salt, all of which the WHO has recommended reducing to help reduce obesity and nutrition related diseases²⁴. Food labelling in the UK is governed by the Food Labelling Regulations 1996²⁵, in accordance with European law. Information on the nutritional content of food products is only required when a nutritional claim is made by the manufacturer, and food contents/ingredients are required to be labelled in a prescribed format. The information given is not necessarily addressed to the lay purchaser and is not always easy to interpret, with many 'low fat' foods for example, not specifying their high sugar content. As a result, campaigners have been calling for new food labelling provisions that would help consumers make healthier choices without having to undertake 'mathematical calculations at the point of purchase' [116]. Since at present there are no binding agreements or any standard European guidelines on front of pack labelling, a number of different formats are currently in use including the 'traffic light' system²⁶ favoured by the UK Food Standards Agency (FSA) and supported by the Faculty of Public Health and leading consumer protection organisations.

The ongoing lack of a full consensus on the format of nutrition labelling prompted the FSA to recently undertake some qualitative research on what consumers are looking for from information labels [121]. Consisting of 10 focus group style sessions with a socioeconomically representative sample of participants, the findings confirmed that there were issues over legibility, and difficulties arising from the varied systems used by different manufacturers. Consumers were however generally keen to retain most of the information that is shown currently on food packaging, as they claim to use it at either 'point of purchase' or 'point of usage'. Identified priorities for improving labelling practices from a consumer perspective were around standardising a range of aspects of pack design, specifically:

- Placing related information together in groups (to assist intuitive searching)
- Standardising where groups of information are found (such as on the front, back or inside of packs) and how it is displayed (e.g. consistent use of icons or a 'contains' box)
- Using best practice design principles (such as, use of boxes and colour coding for delineating different information).

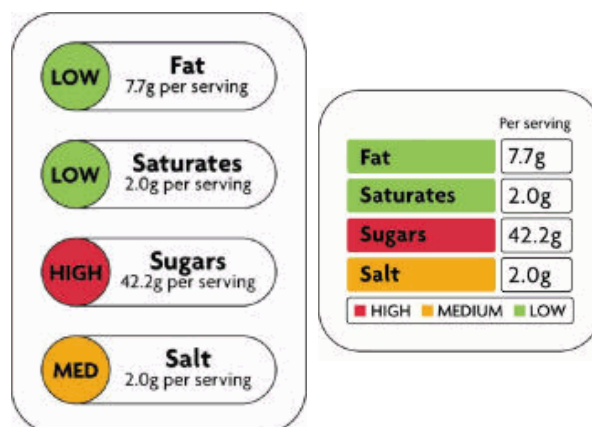
Based on core principles developed by the FSA and used by a variety of manufacturers and retailers, traffic light food labels help consumers make healthier food choices by choosing more products with green or amber lights than red (see figure 5.2). They also enable comparisons between similar products and the system has been found to be particularly useful for pre-prepared and processed foods such as ready meals, breakfast cereals and processed meat products, which can often contain unexpectedly high levels of concealed fat, sugars and salt²⁷.

²⁴ Diet, Nutrition and the Prevention of Chronic Diseases. World Health Organization. Report of the Joint WHO/FAO Expert Consultation. <http://www.who.int/dietphysicalactivity/publications/trs916/en/>

²⁵ The Food Labelling Regulations 1996 [Statutory Instrument No1499] http://www.opsi.gov.uk/si/si1996/Uksi_19961499_en_1.htm#end

²⁶ Traffic light labelling. Food Standards Agency. Eat Well, Be Well <http://www.eatwell.gov.uk/foodlables/trafficlights>

²⁷ Traffic Light Food Labelling: A Position Statement for the Faculty of Public Health; August 2008. http://www.fphm.org.uk/resources/AtoZ/ps_food_labelling.pdf

Figure 5.2 Multiple traffic light labels

(Source: Food Standards Agency – Traffic Light Labelling 2010 [Archived Content]).

A recent randomised study with German consumers [122], compared four different formats of food labels: (1) a simple 'healthy choice' tick; (2) a multiple traffic light label; (3) a monochrome Guideline Daily Amount (GDA) label; (4) a coloured GDA label; and (5) a 'no label' condition. Consistent with the FSA preferred format, the labels found to be most useful were the multiple traffic light labels (figure 5.2), although an increase in perceived health value did not significantly influence food purchasing or consumption. The very wide confidence intervals around most effects listed in table 5.1 however, do suggest that the study was under-powered in terms of sample size. Similar research with consumers in Australia [123], found strong support for the introduction of consistent labelling and that shoppers were five times more likely to identify healthier foods using an FSA-style traffic light system, compared with a monochrome percentage daily intake system [odds ratio (OR)=5.18; $p < 0.001$], and three times more likely compared with the colour coded percentage daily intake system (OR=3.01; $p < 0.05$). The traffic light labels were particularly beneficial for those in lower socioeconomic groups (table 5.1), since this was the format with the broadest intelligibility across all three social groups.

Table 5.1 The odds ratio [OR; 95% CI] of correctly identifying the healthy products from both sets of food products, according to labelling system and socioeconomic status (SES) * $p < 0.05$

Labelling system	Socioeconomic status		
	Tertile 1 (reference group, most disadvantaged)	Tertile 2 OR (95% CI)	Tertile 3 (least disadvantaged), OR (95% CI)
Traffic light	1.0	1.1 (0.3–3.9)	3.7 (0.4–31.7)
Traffic light + overall rating	1.0	4.4 (0.5–39.0)	0.7 (0.2–2.5)
Monochrome %DI	1.0	1.3 (0.5–3.4)	6.3 (1.4–29.2)*
Colour-coded %DI	1.0	0.8 (0.2–2.9)	1.4 (0.3–6.1)

(Source: Kelly et al 2009 [123])

From a public health perspective of course, the case for traffic light labels would be most supported by evidence of an impact on purchasing behaviour towards healthier products, which to date has been confined to retail industry sources and anecdotal reports [124]. A recent short-term quasi-experimental study involving a major UK retailer, and focusing on sandwiches and ready meals, sought to examine whether the introduction of traffic light food labelling would have any discernable effect on purchasing [125]. While there were small but statistically significant increases in purchases of the selected ready meals, there was no change in sandwich sales. More critically, there was no association between changes in product sales and the relative health merits of the products. While it could be argued that the four week intervention was too limited in duration and that the results might have been better had a more comprehensive range of products been included, the findings are nevertheless consistent with the German and Australian studies [122, 123] and would tend to suggest that providing more intelligible health information alone is not a particularly effective means of influencing customer behaviour.

Evidence that traffic light labelling formats encourage manufacturers to reformulate products, in order that they qualify for more amber and green symbols, was until recently confined to industry sources [126]. A recently published persuasive report from the Netherlands however was able to document favourable product modifications (particularly with regard to fibre and salt) in response to a labelling scheme [127]. An editorial in *The Grocer* (a major trade publication for food manufacturers and retailers), was less encouraging and highlighted the lack of a measurable influence on purchasing behaviour as a reason for abandoning the traffic light scheme altogether²⁸. Without the authority to mandate their preferred model, the FSA in all likelihood had no alternative other than to adopt a pragmatic course with major retailers and manufacturers and accept that some would use their own preferred format. An EU Parliament proposal for a European wide mandate to introduce compulsory traffic light labelling was also defeated in June of this year, mainly as a result of intense lobbying from food companies²⁹. A published cost effectiveness analysis from a health care perspective however found that even modest changes in buying behaviour that resulted from traffic light style labelling would offer excellent value for money [128].

Since the traffic light labelling system is now internationally acknowledged as the 'gold standard' for promoting socially equitable consumer awareness (based on studies like those cited above), the defeat of the policy has been described as a retrograde step by consumer groups³⁰. In fairness however, it should be pointed out that a number of UK retailers have in fact introduced front of pack traffic light style labelling as standard, including several large supermarket chains. The nature of the evidence highlights also that front of pack labelling is only likely to be effective in influencing actual purchasing behaviour, if introduced as part of a package of interventions, such as the pricing and social marketing strategies referred to in chapter 4.

iii. *Industrial and agricultural policy frameworks*

Nutrition experts generally agree that minimally processed foods help protect against obesity by virtue of their lower energy compared to their more refined and processed equivalents [48]. Industry profit margins on the other hand, are far greater from highly processed, commodity derived products such as snack foods and beverages which are primarily composed of refined starch, concentrated sugars and low quality fats. These cheap foodstuffs are made even more inexpensive by substantial agricultural subsidies at the national level (see next paragraph). Obesity prevention messages therefore, such as calls to eat less often, eat smaller portions, and avoid high calorie foods of low-nutritional quality, effectively undermine the fundamental business model of most of the commercial food industry [129]. While there are enlightened food companies, society cannot generally expect

²⁸ So consumers ignore healthy-eating labels – and get slimmer anyway. *The Grocer* (Editorial) Nov 2009. <http://www.thegrocer.co.uk/articles.aspx?page=articles&ID=204860>

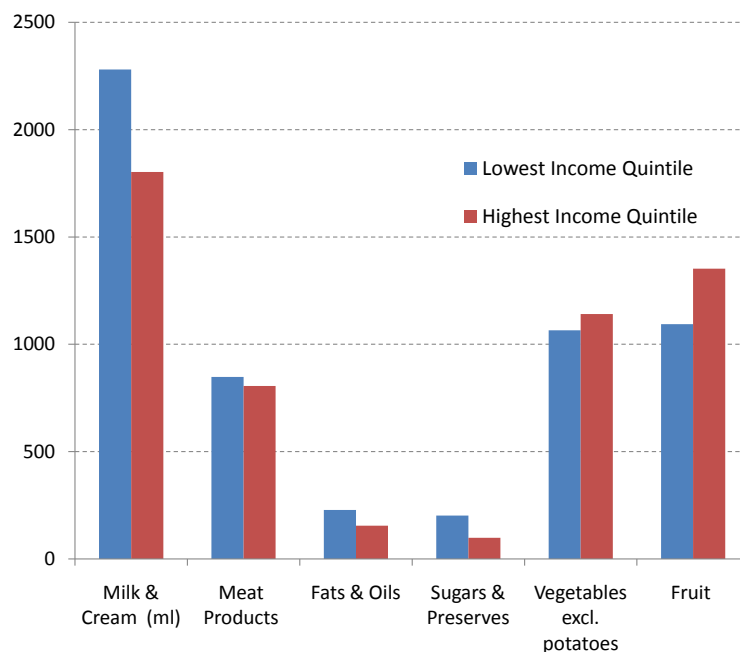
²⁹ MEPs Reject Traffic Light Scheme for Food Products. *The Parliament.com* (EU); June 2010 <http://www.theparliament.com/latest-news/article/newsarticle/meeps-reject-traffic-light-scheme-for-food-products/>

³⁰ Industry Lobbying Sees EU Reject 'Traffic Light' Food Labelling. *The Ecologist*; 17 June 2010. http://www.theecologist.org/News/news_round_up/511976/industry_lobbying_sees_eu_reject_traffic_light_food_labelling.html

long term public health benefits to be placed before the need for commercial organisations to make a profit. It is clear then that there needs to be a measure of protection, possibly in the form of minimum nutritional standards, which would allow companies that are more inclined to engage with dietary improvement at the very least not to be penalised. Such companies would then be motivated to focus on what the food industry has manifestly shown it can do well, which is to find creative ways to satisfy genuine consumer needs and in turn make healthful food choices economical, attractive, convenient and palatable [129].

While a substantive analysis of post second world war agricultural policies in Europe and the US is outside the scope of this review, their intrinsic orientation – towards protecting against food shortages and incentivising high levels of efficient food production – has substantially contributed to the current ‘food energy excess’ environment that has helped fuel population weight gain. The European Union for instance, spends around half of its entire budget or around €55 billion per annum, financing the Common Agricultural Policy (or CAP), in a framework which mainly supports dairy and beef farmers at the expense of fruit and vegetable producers. A far sighted review paper produced by the UK Faculty of Public Health in 2007³¹, highlighted the overt links between heavily subsidised dairy, red meat and sugar production and poor diet, via the mechanisms of price and availability ‘engineered’ by CAP funding arrangements. Relatively high prices for fruit and vegetables are also artificially maintained through large scale disposal of surpluses in the event of bumper crops. The paper argues that while the original aims of CAP around eliminating food shortages and combating rural poverty were well intentioned, their main legacy today is an exacerbation of systemic health inequalities, in that foods with high levels of saturated fat and refined sugar are the most affordable for those on low incomes. Figure 5.3 shows a comparison of selected weekly UK household food item purchases on the basis of relative deprivation.

Figure 5.3 Selected food purchases by household income (grams per person per week, except where otherwise stated, average April 2002 to March 2005)



(Source: DEFRA³²)

³¹ A CAP on Health? The Impact of the EU Common Agricultural Policy on Public Health. Faculty of Public Health; 2007. http://www.fphm.org.uk/resources/atoz/r_CAP.pdf

³² Source: DEFRA Family Food 2004–2005: <http://www.defra.gov.uk/evidence/statistics/foodfarm/food/familyfood/documents/familyfood-2005.pdf>

The faculty discussion paper argues that by implication, hundreds of thousands of premature deaths across the EU could be linked to the adverse effects of CAP subsidies and that there is a pressing need for reform of the policy, if diets are to be genuinely improved and contribute less overtly to population weight gain. Their summary recommendations to EU policy makers were:

- reduce subsidies for beef while encouraging more lean beef production
- reduce subsidies for dairy products and convert excess dairy fat into industrial products such as fuel and lubricants, rather than food products
- ensure only low fat dairy products are subsidised for the 'not for profit' sector
- increase the production of monounsaturated and polyunsaturated vegetable oils
- make greater use of CAP subsidies to incentivise the production of fruit and vegetables
- increase the availability of fruit and vegetables to the 'not for profit' sector through subsidies
- continue to encourage cereal growers sector to produce more unrefined food for human consumption.

Obviously these measures need to be seen as part of a long term strategy and substantial consideration would have to be given towards minimising the disruption to rural economies, ensuring food safety, facilitating sustainable production and preventing animal cruelty. The means by which Scotland could best influence EU-wide policy would also be questionable, were it not for the fact that the rest of the UK and all EU countries (as well as the rest of the developed world) are, to a greater or lesser degree, seeing the same adverse impacts of agricultural policies designed around priorities that were originally set in the middle of the last century. The futility of exhorting populations to eat more healthily, when the whole system of EU and world food production is aiming squarely in the other direction, is difficult to overlook. In order to be credible therefore, any government approach to obesity prevention needs at the very least to be mindful of the adverse effects of dominant agricultural policies. As a significant food and drink exporter, Scotland should be able to contribute to the international debate around reforming agribusiness trade agreements. Some commentators for instance have looked at the case for reducing EU subsidies as a means of bringing the EU more into line with the free trade principles of GATT [130].

5.3 Nutrition intervention (micro-level)

As outlined in 5.2, tackling the obesogenic food environment at the national level will necessarily involve some fundamental challenges to the way foodstuffs are currently distributed and sold. There is also the question of the extent to which Scotland would be able to act independently of the UK on such matters, even if there was a strong political will to do so. Just as with economic interventions however, there is certainly scope for micro-legislative interventions in the more self-contained environments in which people spend much of their daily lives, namely educational establishments and workplaces. Catering within the public sector, particularly in countries like Scotland, where public employees account for a relatively high proportion of the workforce, presents a perfect opportunity to demonstrate that it can be possible to eat healthily on a modest diet. NHS associated information campaigns on healthy eating will also carry more credibility if hospital site canteens and eating premises are recognised for good quality balanced meals³³. Commercial catering premises (hotels, restaurants and takeaways) are also significantly regulated by local environmental health departments and an expanded concept of food safety to incorporate 'obesogenicity' could in theory be locally enforceable. This is an approach which has been used successfully in New York and California where all catering establishments are now required to display calorie information at the point of sale and there are plans to extend a similar requirement across the whole of the US³⁴. This section will summarise the progress of such micro-legislative approaches where they have been used, and explore what might be the best options to take forward in a Scottish context. Since workplace nutrition interventions have already been discussed in chapter 4, the emphasis here will be on the potential for action around commercial food caterers and outlets.

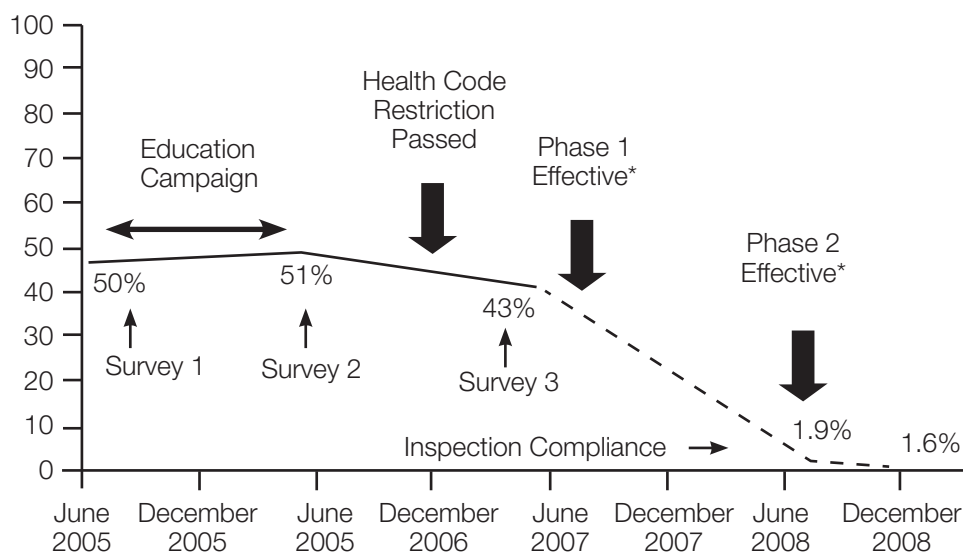
³³ Hospital Restaurant Scoops National Healthy Eating Award. News release. Scottish Consumers Council; April 2007. <http://www.healthylivingaward.co.uk/press%20releases/hairmyrespr.pdf>

³⁴ Calorie Data to Be Posted at Most Chains. The New York Times (Business); Mar 2010 <http://www.nytimes.com/2010/03/24/business/24menu.html>

One obvious strategy for implementing public health measures, where there is a lack of strong evidence (or consensus) on effectiveness, is simply to ‘think local’ and proceed on the basis of local pilot areas in the first instance. As highlighted above, this is an approach which is beginning to acquire considerable momentum in the US where, in an analogous manner to commercial businesses, the interventions which work the best are themselves then propagated to other areas. The previously mentioned efforts to control the use of artificial trans fats in New York restaurants is an excellent example of graded intervention through the initial use of educational and voluntary measures, towards the eventual implementation of a statutory restriction. In an engaging account of the process, Angell and colleagues recently described the key stages building up to legislative enforcement, as information and guidance based measures proved largely ineffective [52]. By June 2008, on the basis of statutory inspection reports, 99% of all restaurants had successfully adapted to the trans-fat fry oil and spread restriction within 18 months of the legislation being passed (see figure 5.4). Two years after New York City's action, 12 USA local governments and one state had adopted similar measures and the impact is being monitored at national government level [131]. The success of the New York measure can essentially be attributed to three factors:

- (i) The initial information based campaign which raised industry awareness and generated public support
- (ii) The capacity to make use of existing public health infrastructure for implementation and enforcement
- (iii) The lack of any adverse economic impact whatsoever, since all establishments were treated the same and suppliers quickly adapted.

Figure 5.4 New York City restriction of artificial transfat. Reduction in use in frying, baking or cooking or in spreads.



(Source: Angell *et al* 2009 [52])

Notes: Data from 2005 to 2007 are from surveys. July and November 2008 data are based on restaurant compliance data collected during regularly scheduled inspections. Compliance data are further adjusted to be consistent with survey denominator.*Phase 1 of the regulation only covered fats used for frying or as a spread. Phase 2 covered all other foods and ingredients.

The most compelling aspect from a public health point of view, when compared to an information based campaign (as favoured by retailers), is that avoidance of the risk is not dependent on the individual consumer's knowledge. This is especially relevant when considering the health needs for the more vulnerable sectors of the population, especially children (who are particularly prone to disregard future

health risks) and lower socioeconomic groups (who are the least likely to be well informed about hidden health risks). Of course, the assumption that extending the same logic to restrictions on specific energy dense food products to tackle obesity would be similarly effective is problematic since there is an added behavioural component to such food choices and issues around substitution with other high energy / low nutritional value foods are rarely explored.

Summary

Legislative interventions – nutrition (macro and micro)

- Traffic light format ‘front-of-pack’ food labelling is clearly the most intelligible and accessible means of conveying nutritional information to consumers, although its capacity by itself, to impact favourably on purchasing behaviour has yet to be demonstrated.
- Recent evidence from within Europe has provided preliminary confirmation that traffic light style food labels can encourage product reformulation by manufacturers.
- Food energy over consumption in western advanced societies is closely tied up with over production, which has resulted from deliberate agricultural subsidy frameworks that were originally intended to prevent shortages. A shift in emphasis towards the production of less energy dense whole foods, as well as fruits and vegetables would help redress the current imbalance.
- Mandatory legislation, that makes use of existing public health monitoring structures, is an effective and rapid mechanism for introducing favourable changes into the commercial catering industry, particularly where information based guidance has not had any impact.

5.4 Physical activity interventions (macro-level)

While governments by necessity exert a certain amount of control over the food supply, the same cannot be said for population levels of physical activity. As discussed previously in chapter 3 however, there are many features of the built environment which impact on likely levels of physical activity, most notably perceptions of road safety as well as personal safety and access to local amenities. The Foresight Report [2], referred to in chapter 2, emphasised the need for planners and policy makers to undertake specialised obesity focused ‘health impact assessments’ when introducing new policies and changes to the built environment. Their one specific proposal around activity called for measures to increase the walkability and cyclability of the built environment. The transport infrastructure comparisons with mainland Europe, also covered in chapter 3, demonstrate what might be possible, but at the same time highlight the very substantial changes in thinking that need to take place at all levels of government. While visionary reports like that produced by the Foresight team, allow for some guarded optimism, the implementation of substantial political interventions has to date in the UK been inconsistent at best [132]. Among the more promising approaches, has been the Department of Health’s Change4Life campaign, discussed in chapter 6 and, in the area of structural changes to support active travel, the establishment of six cycling demonstration towns (CDTs). In October 2005, Cycling England established six CDTs in England. The towns were chosen following a competitive process, and were awarded funding to enable them to take a comprehensive approach to promoting cycling through a combination of dedicated facilities, capital investments and educational campaigns. The towns each received funding of £500,000 per year which, with matched funding from the local authority, equated to £10 per head of population per year (details of the towns and their cycle promotion programmes are available from the Cycling England website³⁵). Using data from automatic cycle counters, the mean increase in cycling levels across all six towns was 27% (based on % difference between 2006 and 2008). Table 5.2 shows changes in the percentages of people participating in cycling compared to non-demonstration towns.

³⁵ <http://www.dft.gov.uk/cyclingengland/cycling-cities-towns/results/>

Table 5.2 Percentage of active people survey respondents participating in cycling for at least 30 minutes once or more per month, 2006 and 2008

	2006	2008	Difference (and 95% CIs)	P-value for difference
Local authorities with a Cycle Demonstration Town	11.77%	15.07%	3.30% (1.79–4.81)	0.0000
Local authorities with no Cycle Demonstration Town	11.33%	11.85%	0.52% (0.34–0.70)	0.0000

Although an increase is evident, the modest extent of the improvement, from around 12% to 15%, is perhaps unlikely to be seen as a worthwhile infrastructure investment on the basis of behaviour change results alone. In order for government to be willing to make the substantial capital investments that would be required to support wider implementation of such programmes, decision makers might understandably wish to hear about the cost effectiveness and cost benefits of ‘active-travel’ orientated structural improvements. To this end, the WHO Regional Office for Europe recently convened an expert panel to develop a methodologically robust tool that would be able to quantify the cost savings attributable to walking and cycling improvements [133]. The resulting Health Economic Assessment Tool (HEAT) for cycling is currently being used in a number of EU countries including Scotland. Although HEAT uses only the likely reductions in mortality which increased cycling would lead to (and is therefore likely to underestimate the health benefits per unit cost), the resulting anticipated health savings are nevertheless substantial. Results of applying the model in Scotland for instance, assuming that interventions are able to increase the prevalence of cycling for all journeys less than 5 miles by 20% to 40%, would result in societal savings in the region of £2 billion per annum.

5.5 Physical activity interventions (micro-level)

Micro-level interventions, mediated through legislative means, are essentially concerned with measures to facilitate behaviour change, and are discussed for physical activity in some detail in section 6.5. As with interventions at the macro-legislative level, the relatively underdeveloped nature of the evidence base means that any such interventions, including the financial incentives discussed briefly in chapter 4, need to be introduced alongside provision for robust evaluation. One exception where there is an increasingly favourable evidence base is in the area of workplace active travel plans, discussed in section 6.5. In many cases such plans include numerous workplace policies and incentives, including government supported initiatives like the ‘cycle to work’ scheme³⁶.

Summary

Physical activity interventions

- Legislative incentives to promote physical activity should ideally be accompanied by environmental and infrastructural improvements outlined in section 3, if they are to be effective in increasing both leisure activity and active forms of travel.
- Capital investments in active travel infrastructure, such as cycling and walking routes, have been demonstrably linked to modest increases in these forms of travel in a number of English cycling demonstration towns.
- The application of novel cost effectiveness modelling techniques such as HEAT (Health Economic Assessment Tool), to active travel improvements, illustrates that significant societal savings could result from increases in cycling in Scotland, towards the levels seen in other Northern European countries.

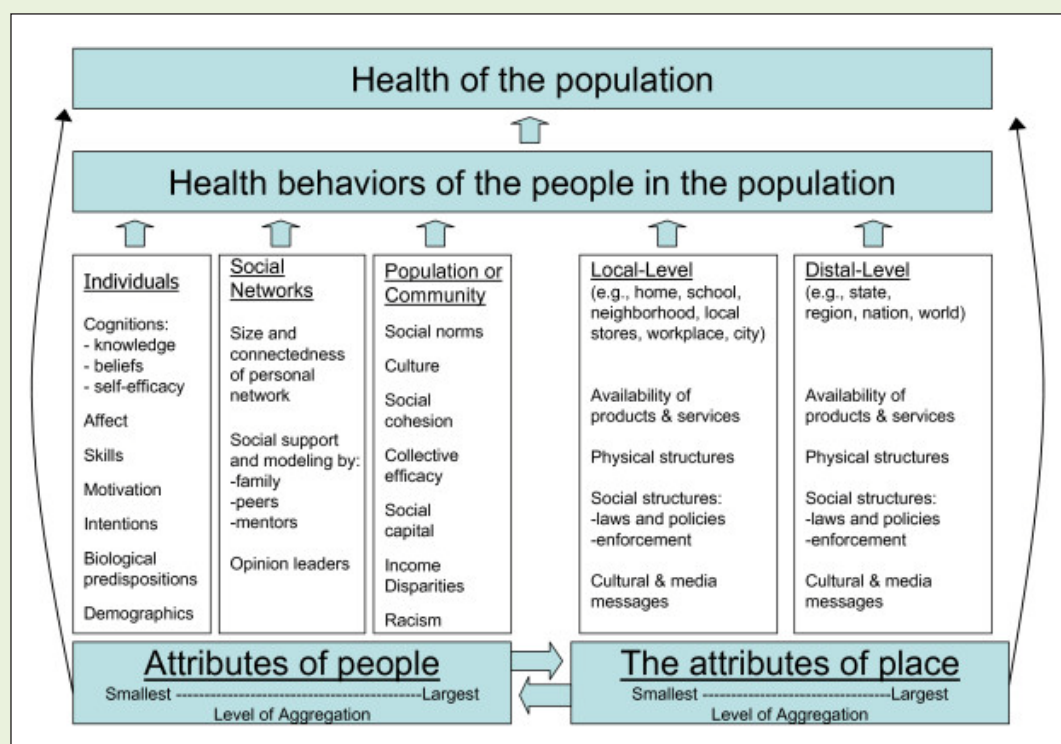
³⁶ Tax-free bikes for work. <http://www.cyclescheme.co.uk/>

Chapter 6 – Interventions in the sociocultural environment

6.1 Introduction

According to its broadest interpretation, the sociocultural environment relates to all the characteristics of individuals and populations that influence beliefs and behaviours, as well as the surrounding 'information environment' and the interactions between all three. For the purposes of conceptualising public health interventions, Maibach and colleagues [134] have proposed a streamlined ecological model of these interactions which they call their People and Places Framework (see figure 6.1). The framework firstly describes the relevant attributes of people as operating in individual, social network and community or population levels of analysis, and secondly the relevant attributes of place as operating in local or distal levels (the latter distinction being analogous to the macro- and micro- levels of intervention in the original ANGELO framework). The authors subsequently refer to these five levels of analysis as 'fields of influence' in order to explicitly focus on identifying opportunities for public health action, as opposed to elaborating on the theory behind them. The 'fields of influence' concept is particularly useful therefore for designing measures to affect behaviour change, aimed at the social/cultural environment.

Figure 6.1 A people and places framework for public health influence



(Source: Maibach *et al* 2007 [134])

Individual based factors that influence health and health behaviour have been subjected to considerable research activity since the origins of psychology, and its application to communication and health education. With the exception of biological predisposition and demographics, most of the individual level attributes in figure 6.1 (cognition, mood, skills,

motivation and intention) have been shown to be amenable to change through external intervention. There is also an extensive literature around the influence of social networks and health [135], the most relevant attributes being the size and connectedness of a person's social network, the diversity of ties and the degree to which the various relations in a social network provide social support and positive modelling. The most significant determinants of health behaviour in communities and local populations remain perhaps the least well understood [134], although much attention has recently focused on collective resources such as social capital and community cohesion. The extent of socioeconomic disparity or the income gap between the most affluent and least well-off, has of itself an independent effect on health behaviours and outcomes [136]. 'Place-based' fields of influence can be subdivided into four factors, three of which have already been covered in previous chapters of this report:

- i. Availability of products and services (Chapter 3: Physical environment (micro-level))
- ii. Physical structures (Chapter 3: Physical environment (macro-level))
- iii. Social structures/laws and policies (Chapters 4 and 5)
- iv. Media and cultural messages (Chapter 6: Current).

Using the convention adopted in previous chapters, macro-level factors (e.g. mass communication) will be considered before individual or micro-level influences. Of course the predominant cultural attitudes towards obesity itself are subject to substantial variation throughout the world, which inevitably influences the preferred approach to prevention. Certain commercially engineered cultural 'norms' such as the associations for children between fast food and fun, or between confectionary and innocent pleasures for adults, also highlight certain strongly embedded cultural attitudes which need to be acknowledged by preventative strategies, if not directly challenged.

6.2 Nutrition Interventions (macro-level)

Although mass media is undoubtedly a significant reflector and potential frame-setter of the adult sociocultural environment, the vast majority of published evidence in relation to media and nutrition is heavily focused around children. Research has also confirmed that hours spent viewing television correlate with measures of poor diet, poor health and obesity among both children and adults. Three explanations for this have been offered [137]:

- i television viewing is a sedentary activity that displaces more active pursuits
- ii television viewing is associated with frequent snacking, pre-prepared meals and/or fast food consumption
- iii television viewing includes exposure to advertisements for unhealthy food products.

While each of these explanations is supported by observational studies, there has been a shortage of empirical research aimed at disentangling them from each other. The one intervention to date has been a progressive ban in the scheduling of advertisements for food and drink that is high in fat, sugar and salt (HFSS) introduced by the broadcast regulator OFCOM after extensive consultation in 2006. The phased reduction in HFSS advertising began in April 2007 with a ban on HFSS advertisements in programmes aimed at children aged 4–9 years and culminated in a ban on all HFSS advertising on children's channels with the age group extended to include those aged 5–15 years. A preliminary evaluation of the ban noted expected levels of reduction in the amount of advertising that children see, although there had been some migration of HFSS advertising to programmes watched by both adults and children³⁷. In spite of these drawbacks, the UK's approach has received international commendation and statutory measures have been clearly shown to be more effective than self regulatory regimes [138].

A recent US study has provided additional retrospective justification for the targeting of commercials, where the extent of exposure to commercial television was significantly associated with BMI even after adjustment for levels of exercise and eating while watching television [139]. A multi-country comparison by Goris and colleagues used an attributable fraction model to estimate the relative reductions in child obesity that would result from a hypothetical complete absence of food advertising on television [140].

³⁷ Update on Impact of Restrictions on Food and Drink Advertising to Children. OfCOM; 2008. <http://stakeholders.ofcom.org.uk/market-data-research/tv-research/update/>

Unsurprisingly perhaps, the greatest scope for reductions were for the countries with the highest daily TV advertising exposure such as the US and Italy (11.5 and 6.2 minutes of total advert exposure per day respectively). Of course the widespread distribution of promotional material for unhealthy food in the modern consumer environment, means that assumptions about reduced overall message exposure are necessarily crude. Furthermore, extrapolating any implications for adult obesity prevention from family orientated interventions, involves making a number of significant assumptions and calls for a cautious interpretation.

6.3 Nutrition interventions (micro-level)

Micro-level interventions around the cultural environment and food have already been touched upon when describing the works and college canteen studies in chapters 3 and 4, where the most effective lever to bring about improved purchasing behaviour, at least in the short to medium term, was identified as price differentials. There are of course a whole host of strongly embedded cultural associations around less than healthy food practices, which is particularly the case for Scotland and often of most relevance within the family or home environment. Thankfully this has recently been the subject of a comprehensive review commissioned by NHS Health Scotland and undertaken by the Food Ethics Council [141]. The report takes a broad definition of food culture as ‘shared practices and meanings relating to food’, and making comparisons with three other European countries (France, Finland and Greece) examines the culturally specific factors and attitudes that influence dietary practices in Scotland. Notably the review shows how certain practices and meanings people attach to food can reflect and reinforce their membership of socio-economic groups, as well as directly affecting their diet and health. The report also explored the reasons behind greater tendencies towards unhealthier practices, such as skipping breakfast or reliance on take-away meals and found that time pressures (actual or perceived) were one of the highest cited factors. In terms of previous policy interventions and their rationale, the authors highlight how the cultural practices which underpin much of the Scottish population’s dietary habits are rarely unpacked meaning that intervention messages and initiatives might have limited relevance to the target population. Current nutrition related policy measures in Scotland are discussed in section 7.2.

Summary

Nutrition focused interventions

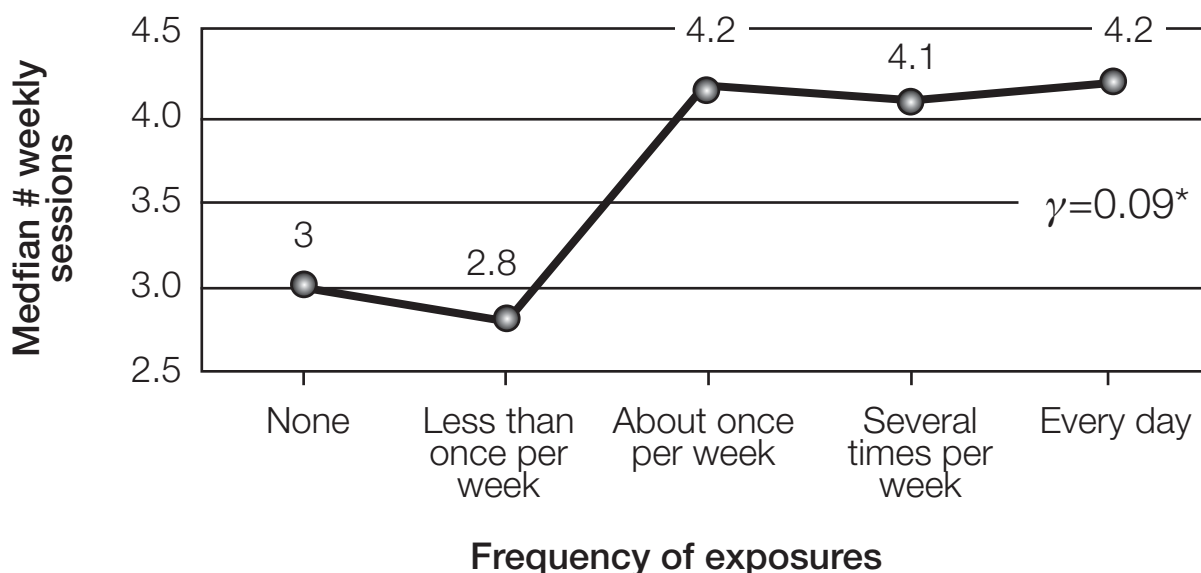
- The highly embedded nature of obesogenic drivers in modern society is particularly evident within the predominant media and cultural messages which associate energy dense foods with pleasure and reward.
- Controls on high fat / high sugar (HFHS) food advertising to children might be one intervention that can help unpick the largely unchallenged positive associations that these foods generally enjoy, although advertisers have shown themselves to be adept at working around such restrictions.
- Multi-component nutrition interventions, discussed in previous chapters, have had some success in changing workplace and institutional food cultures.
- The complex cultural context underlying much of Scotland’s poor dietary habits and practices is rarely explored, which could undermine efforts at improvement.

6.4 Physical activity interventions (macro-level)

The vast majority of efforts around facilitating behaviour change at the macro-level are centred on moderate to large scale media campaigns. Abroms and Maibach describe two features of effective public health media campaigns [142]: they feature well defined messages and those messages are delivered to their intended audiences with sufficient reach and frequency to be seen or heard and remembered. From existing reviews of mass media campaigns, which focus for the most part on changing individual behaviours, it is also clear that effect sizes in well designed studies are modest at best [142]. Snyder and

Hamilton's meta-analysis of 48 published, community wide campaigns, for example, found an effect on population behaviour in the short term to be an attributable risk difference of 0.09 (i.e. 9% more people adopt the behaviour than did so before the campaign) [143]. Perhaps not surprisingly, larger effects were seen for behaviours that were enforceable by law (e.g. seat belt use=0.17) than for 'purely persuasive campaigns' (of the order of 0.05). Larger impacts were also associated with campaigns that had a higher reach (i.e. a larger proportion of the target audience were exposed) and for those that presented new information [142, 143]. Virtually all contemporary media campaigns now include the creation and promotion of websites, the more sophisticated of which also usually include interactive features. Although robust evaluations of web-based campaigns are still relatively rare, they can be a very effective means of achieving a high level of reach and engagement in settings with widespread internet connectedness. The CDC's 'VERB' campaign is a nationwide initiative aimed at increasing physical activity among children aged 9–13 years, which began in 2002 and generated more than 10 million visits to its website [142, 144] over the first two years. Subsequent evaluation of the programme showed an impressive dose-response increase in self reported, free-time physical activity with increasing frequency of exposure to the VERB site (figure 6.2) [145].

Figure 6.2 Median number of free time physical activity sessions (self reported) among children aged 9–13 years in past 7 days, by frequency of exposure to VERB, 2004. * $p < 0.05$



(Source: Huhman *et al*, 2007 [145])

γ (gamma) statistic for dose response, range: +1.0 (denoting perfect +ve correlation) to -0.1 (denoting perfect negative correlation).

Although VERB results are largely based on self reports, the evaluation is tied to a nationally representative longitudinal cohort survey (Youth Media Campaign Longitudinal Survey [YMCLS]). In addition to correlating activity reporting with campaign exposure as in figure 6.2, the survey also looks at three psycho-social dimensions of physical activity:

- i. Outcome expectations (i.e. beliefs about benefits)
- ii. Self-efficacy (i.e. confidence to overcome barriers)
- iii. Social/family influences (household and peer-group attitudes).

The self reported activity data was also cross-correlated with detailed logs for organised and free time activity; the validity coefficients found to be as high as (or higher than), similar seven day recall instruments [145]. The VERB evaluation therefore is sophisticated enough to assess any underlying changes in attitudes, as well as effects on physical activity. Although measurable effects in the first year were confined to free time physical activity in defined sub-populations (e.g. 9 to 10-year old girls),

the second year saw an expansion of effects to the entire target population on three outcomes (free time activity in past week; any physical activity on the day prior to interview; and expectations around outcomes). While the average effect overall was modest (attributable risk difference of 0.05), projection to a national scale corresponds to an acceptably low cost-per-child for achieving underlying behavioural and attitude changes that might well be sustainable (due to psychosocial benefits). Although obviously aimed at children, any long term strategy to modify adult attitudes is likely to be most effective if it can have an impact on the formative years.

The English Change4Life marketing campaign³⁸, launched in January 2009, has been compared to VERB although its approach extends beyond physical activity and its principle audience is intended to be young families. Based on a review of the effectiveness of social marketing techniques to facilitate healthy behaviour change, the campaign focused on four priority population segments to help overcome barriers to an improved lifestyle. Each segment was characterised with particular identifiable barriers (e.g. segment 3 were often quite affluent families who tended to treat their children with unhealthy snacks). Considerable attention has been devoted to the development of a multi-component evaluation, including a randomised study with a control group to assess the impact of the Change4Life materials on family behaviour. Early results around process and awareness outcomes have exceeded set targets and have been very encouraging³⁹. The campaign has also now been extended and tailored for at risk adults (aged 45 to 65 years)⁴⁰ although the recent change of government in the UK is likely to lead to alterations in many programmes.

As with Change4Life, not all media campaigns to increase physical activity are exclusively focused on children and there have also been a number of well designed studies in adults, the 'Wheeling Walks' programme in West Virginia being one example [146]. This quasi-experimental multimedia educational intervention targeted 31,420 adults and made use of the theory of planned behaviour change to target those likely to be most responsive or susceptible to the campaign messages. The results were also partly verified by the inclusion of a (relatively crude) direct observation component in addition to the self-report measures. Although the intervention group differed from the comparison group on only one of the three activity report outcomes (moderate-intensity walking: see table 6.1), respondents in the intervention community reported walking more minutes (mean=122.9 minutes/day versus 87.6 minutes/day; $P<0.003$) than those in the comparison community. Direct observation data also showed a significant effect, with a 23% increase in walking observations in the intervention community versus a 6% decrease for the comparison area (OR=1.31, 95% CI: 1.14 to 1.50).

Table 6.1 Pre to post changes in self-reported physical activity (as recommended by Centre for Disease Control and US Surgeon General) among sedentary older adults

CRITERION [Telephone survey – self report]	Intervention community changes	Comparison community changes
Moderate–intensity walking for 30 min or more a day at least 5 days a week	32.2%* #	18.0%
Moderate–intensity physical activity for 30 min or more a day at least 5 days a week	22.9%	19.6%
Vigorous–intensity physical activity for 20 min at least 3 days a week	9.9%	8.7%

³⁸ NHS Change4Life Campaign: <http://www.nhs.uk/change4life/Pages/default.aspx>

³⁹ www.obesitywm.org.uk/.../Change4Life_Evaluation_-_revised_16.11.09.doc

⁴⁰ http://webarchive.nationalarchives.gov.uk/+www.dh.gov.uk/en/MediaCentre/Currentcampaigns/Change4Life/DH_112678

Given the established importance of underlying attitudes in determining the take up and maintenance of changed behaviours however, perhaps new the most compelling result of Reger *et al*'s study is the parallel with the CDC's VERB campaign, in that there were measurable, statistically significant changes for the better, in both 'intention' and in 'perceived control'. Such an outcome is consistent with meeting the pre-conditions for a sustainable change in usual habits, within the basic trans-theoretical model of behaviour change. The authors had also undertaken pre-testing research during the design phase of their study and found that while sedentary and irregularly active people in their target population shared similar 'attitude and norm beliefs' with regular exercisers, they did show strong differences in perceived control. The educational messages were then tailored to influence perceptions of control over time and scheduling, thereby directly addressing the main barrier to increasing activity levels.

The importance of being able to transform attitudes was previously highlighted in the discussion on active travel and perceived safety in chapter 3 (New York cycling example). Mass public participation events also offer a highly visible and striking demonstration of what can be possible with large scale coordinated efforts across major cities. The city of Bogota in Colombia was the first to embrace the idea as a means of beginning to combat excessive congestion and pollution. Now taking place every Sunday, 70 miles of city streets are closed to traffic and residents come out in their thousands to 'walk, bike, run, skate, recreate, picnic, and talk with family, neighbours and strangers'.^{41,42}

Figure 6.3 Ciclovía, Bogota, Columbia – the first and remains the largest of citywide regular mass cycling events (see footnote for weblink to short film item).



(Source: La Vida Es Loca Wordpress pictures: lavidaesloca.wordpress.com)

The effectiveness of mass community cycling events in improving public self-perceptions of cycling ability was neatly illustrated in an Australian study in 2006 [147]. While participants in the Sydney event were predominantly male and under 50 years of age, there were impressive changes in perceived cycling ability and in rates of cycling for participants as a whole, after the single event 'intervention'. Specifically, half of the survey respondents that rated their cycling ability as low before the event, subsequently rated their ability as high one month afterwards. Also, respondents with low pre-event self-rated cycling ability reported an average 4 sessions of bicycle riding the month before the event and an average 6.8 sessions a month after the event, which was strongly statistically significant ($p < 0.0001$). The demonstration of such immediate benefits and returns in population attitudes and habits has initiated a growing international spread of such organised events with one taking place in Ireland in August 2010⁴³. The closely related 'critical mass' cycling events, which originated in San Francisco, have also been spreading internationally and several have taken place in Edinburgh in recent years. Not formerly organised, these events depend on the organisation of a 'critical mass' of cyclists to literally take control of the roads⁴⁴.

⁴¹ Ciclovía: Bogotá, Colombia. <http://www.streetfilms.org/ciclovía/>

⁴² Streets as trails for life. <http://www.americantrails.org/resources/health/streetspenalosa.html>

⁴³ International Cycling Event Launched in Ireland: www.bicycle.net/.../international-cycling-event-launched-in-ireland

⁴⁴ Critical Mass Edinburgh FAQ. <http://www.edinburghguide.com/criticalmassedinburgh>

Summary

Physical activity interventions (macro-level)

- Although effect sizes in mass media campaigns to encourage healthy behaviours are modest at best, they can, because of scale, have the potential to result in significant population health gain if they can help bring about small shifts at the national or regional level.
- Large scale public participation events are being recognised as an effective means of beginning to change population attitudes and behaviours, as well as individual perceptions of ability.

6.5 Physical activity interventions (micro-level)

In looking to influence prevailing attitudes to physical activity, it might be expected that interventions which are carried out in close proximity to their target population, should be better able to tailor their approach appropriately. Micro-level interventions around activity could in principle be targeted at the individual, household or institutional/workplace level, all three of which will be considered in the current section. Specifically, the merits of the respective published evidence will be summarised for:

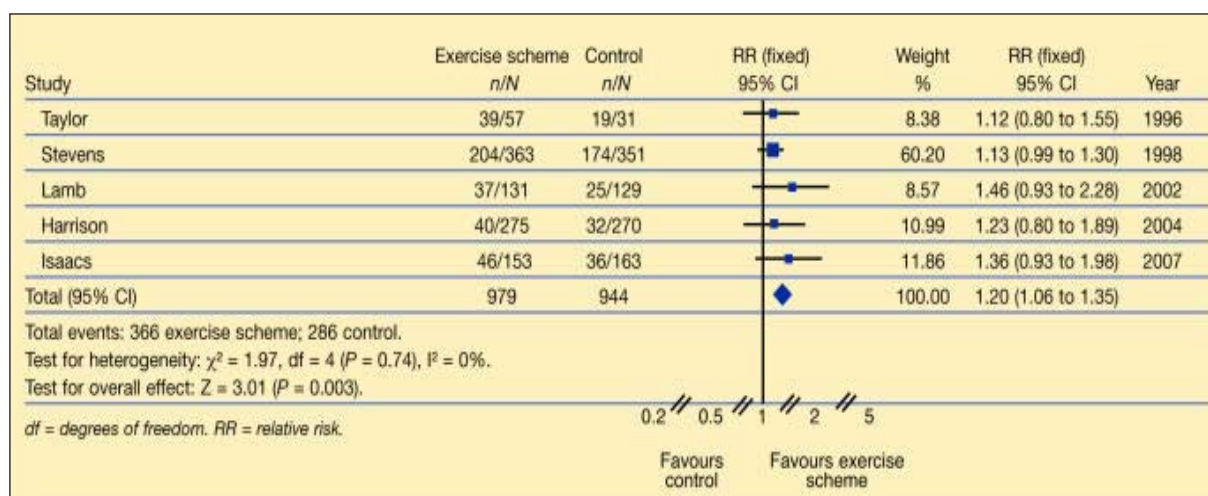
- i. Primary care exercise referral
- ii. Household targeted active travel
- iii. Workplace active travel 'culture'.

i. Primary care exercise referral

Since this report purposely does not address obesity treatment, individual level interventions were not originally considered as part of its original brief. Exercise referral however, is also commonly used for obesity prevention (principally in primary care, for patients at high risk of developing obesity and its complications). So called 'exercise on prescription schemes' have been considered by the National Institute of Clinical Excellence (NICE) which published a best practice guidance summary in 2006⁴⁵. Mindful of the equivocal nature of the evidence NICE, recommended that referrals should be issued only as part of a formal research studies. Subsequent interpretation of the guidance by NHS Health Scotland endorsed this opinion and concluded that new schemes should only be set up as part of a designated evaluation programme⁴⁶. The most recently published systematic review of exercise referral schemes by Williams *et al* (see table 6.2) concluded that they may have a marginal impact in increasing physical activity in sedentary people, though problems with take up and adherence meant that 17 referrals were necessary for every one patient who successfully took up 'moderate activity' [148]. One complication was the level of variation in follow up, and although the majority of studies reported at 10 to 12 weeks, this is probably too soon to be able to evaluate sustained effectiveness. Exceptions were one study that reported at four months and another at two years.

⁴⁵ Four Commonly Used Methods to Increase Physical Activity. NICE Public Health Intervention Guidance No 2; 2006. http://www.nice.org.uk/nicemedia/pdf/PH002_physical_activity.pdf

⁴⁶ NHS Health Scotland Interpretation of NICE PG002: Four commonly used methods to increase physical activity.. <http://www.healthscotland.com/uploads/documents/8449-NICEPHIG2HScmentarySummary10Aug06.pdf>

Table 6.2 Meta-analysis of exercise referral schemes compared with control according to the proportion of participants who took moderate exercise

(Source: Williams *et al*, 2007 [148])

ii. Household targeted active travel

Chapter 3 outlined the importance of structural interventions, particularly around safety, as a means of overcoming barriers which discourage active travel. The long established priority given to promoting sustainable transport in mainland Europe however, has also meant that public attitudes and reasons behind travel mode choice have been the subject of considerable research since the 1970s. Research in Germany in particular revealed that for at least 25% of non public transport journeys, the reasons underlying the choice were relatively trivial and were amenable to ‘voluntary change’ with simple targeted information provision and discussion [149]. The use of such relatively soft intervention measures aimed at voluntary travel behaviour change (VTBC), has now been evaluated in many countries including parts of the UK. Beginning in Germany in the late 1980s, individualised travel marketing (ITM), has been commercially implemented under the brand name ‘IndiMark’. Also referred to more generically as ‘personalised travel planning’ (PTP) programmes, their evaluation can be methodologically challenging since the precise tools and techniques vary between projects. The components for example typically include one or more of the following: (i) one-to-one conversations with trained travel advisors; (ii) information provision on sustainable travel (e.g. train and bus timetables, cycling and walking routes); and (iii) gifts and incentives to encourage sustainable travel (e.g. pedometers, water bottles, bus passes etc).

An analysis which combines the results from three projects in Nürnberg [149], was able to demonstrate an overall increase in public transport use of 13%, alongside a 3% reduction in trips as a car driver and, less positively from an active living perspective, a 6% reduction in cycling. Consistent with guidance from sustainable travel experts, that larger scale trials are more effective, an encouraging Australian study of the ‘Travelsmart’ programme reports a 14% reduction in car use in South Perth [150], which appeared to have been ‘locked in’ and was sustained at 13%, four years after the intervention. These evaluations are highly typical of almost all studies in this area, in that they present a number of significant challenges to interpretation which were well described in a meta-analysis by Möser and Bamberg [151]. Their major concerns about PTP studies include weak study designs without controls, non representative (often

self-selected) population samples and a high reliance on self reporting with the attendant risk of ‘social desirability’ bias. Considering also that most of the reported studies are not independent evaluations, but instead often originate from commercial consultancies supplying the interventions, the potential for publication bias was an additional cause for concern.

Having documented their reservations about the available literature, the authors of the review had gathered sufficient information to be able to derive pooled effect-sizes from a total of 141 studies (see table 6.3). Although there was considerable heterogeneity among the included studies across the three settings (i.e. community travel planning/awareness; work travel plans and school travel plans), the increases in sustainable travel choices were all strongly significant ($P < 0.001$) with effect sizes of the order of 0.10 to 0.15 for travel-planning, and 0.24 for workplace programmes. Translating these findings into meaningful implications for planning travel programmes, the estimated increase in the proportion of trips overall not taken by car was from 34% to 39%⁴⁷. Work travel plans resulted in an estimated increase from 35% to 47% and for schools the overall estimated proportion not travelling by car increased from 60% to 64%. Although these likely benefits remain very marginal, the review authors are still careful to caution against the generalisability of the pooled results due to the study design reservations highlighted above.

A recently published evaluation of PTP projects in eight areas of England [152], highlighted many of the same concerns over study design as Möser and Bamberg. The one reassuring aspect was that the results range – a 4% to 13% reduction in car driver trips – is in broad agreement with the larger review and also consistent with results from Australian investigators [150]. The largest increases in the English studies were reported for walking, even though most information requests were around public transport and there were specific cycling promotions in several of the pilot sites. Having been involved in many PTP evaluations in the UK, Peter Bonsall of the University of Leeds shares fully the previously cited criticisms about the study literature [153] as well as adding his own concerns around the lack of long term follow up and the minimal consideration given to likely economic impact. As a way forward, he suggests that new and ongoing PTP schemes such as the Scottish Government’s ongoing Smarter Choices, Smarter Places initiative⁴⁸, ought to be mindful of the importance of continuing to improve the evidence base and that any such projects need to set aside sufficient resources for independent evaluation (i.e. that is not undertaken in-house by the contracted provider(s)). Novel research strategies, such as traveller segmentation analysis (which looks at the social demographics and lifestyle profiles associated with different forms of travel) [154] are also likely to be of considerable benefit in expanding researchers’ understanding around the complexities of travel choice.

iii. Workplace active travel ‘culture’

Finally, given the working age group focus of this report, the results seen with workplace travel plans (see table 6.3), are worthy of particular mention. A mean increase of 12 percentage points in the proportion of employees not coming to work by car, in combination with reassurance on the absence of biased reporting, is by itself an encouraging indication of the potential for workplace travel plans to stimulate behaviour change [151]. One particularly successful component of work travel plans has been the government’s assisted bicycle purchase scheme in which employees receive assistance to buy a bike tax free for the purposes of commuting. For the UK as a whole in 2007, more than 10,000 employees took advantage of the scheme⁴⁹. Of course the extent to which bike purchases translate into journeys will also be affected by many other factors, which is why workplace active travel measures need to be multi-component and incorporate assistance with information on routes, dedicated bike storage facilities and the provision of showers and changing facilities.

⁴⁷ Translating effect sizes. The methodology is relatively complicated and outlined in the review. The author’s use the dimensionless Cohen’s h statistic to relate the effect size to the original proportion of the sample (between 0 and 1) whom were ‘not transformed’.

⁴⁸ Smarter Choices, Smarter Places initiative: <http://www.scotland.gov.uk/Topics/Transport/sustainable-transport/home-zones>

⁴⁹ Cycling To Work Saves 8,000 Tonnes Of Carbon Emissions http://www.planning-inspectorate.gov.uk/pins/publications/newsletter/issue_11/cycle_scheme.html

Table 6.3 The pooled mean effect sizes calculated under the fixed- and random-effects assumption[#] for the all studies and for studies evaluating the three soft policy measures separately

Model	Mean ES	-95% CI	+95% CI	SE	Z	df	Q	V
All studies (N=141)								
Fixed effects	0.12	0.11	0.13	0.01	26.53***	140	1517.58***	
Random effects	0.15	0.12	0.19	0.02	8.75***			0.03
Travel planning/travel awareness campaign/PT marketing (N=72)								
Fixed effects	0.10	0.09	0.11	0.01	14.01***	71	122.72***	0.00
Random effects	0.11	0.08	0.13	0.01	8.25***			
Work travel plans (N=44)								
Fixed effects	0.24	0.22	0.25	0.01	30.61***	43	758.36***	
Random effects	0.24	0.17	0.31	0.04	6.87***			0.05
School travel plans (N=25)								
Fixed effects	-0.01	-0.03	0.01	0.01	-1.23	24	205.55***	
Random effects	0.08	0.02	0.14	0.03	2.56**			0.02

(Source: Möser and Bamberg 2008 [151])

ES, effect size; CI, confidence interval; Q, homogeneity measure; V, random effects variance component.

[#] A random effects model takes account of between study variability in the estimate of the overall effect size, whereas a fixed effects model does not; *** $p < 0.001$; ** $p < 0.01$.

As part of a study commissioned by the Department of Transport, Cairns *et al* looked at work travel plans in seven UK towns [155] and found that they typically reduced commuter car driving by between 10% and 30%. The typical cost to the local authority for the promotion of the schemes was £2 to £4 per affected employee, per year. City/urban area authorities who prioritised work travel plans were able to engage with around 30% of the area workforce, compared with 10% in rural authorities. Workplace travel plans were also the most cost effective in terms of price per vehicle-km reduced. The authors conclude that 'smarter choice' i.e. 'soft' travel measures have the potential to reduce national traffic levels by about 11%, and by up to 21% at peak periods. While all of the above uncertainties around the evidence still need to be borne in mind, these estimates are for soft measures alone and do not take account of the likely enhanced effectiveness of combinations with structural interventions.

Summary

Physical activity interventions (micro-level)

- Individually focused activity incentives (such as primary care based exercise referral), have been shown to be marginally effective for promoting physical activity in people who are largely inactive. Although too resource intensive to be a useful means of obesity prevention in the general population, their medium to longer term effectiveness in higher risk groups, would be worthy of further evaluation.
- Personal travel planning (at household level), has been associated with very consistent reductions in car dependent travel, although there are significant concerns with the quality of the evidence base. Further public investment in such programmes should make provision for independent robust evaluation.
- Workplace travel plans have been shown to be cost effective and feasible in a UK setting, as a means of reducing the proportion of car dependent journeys.

7

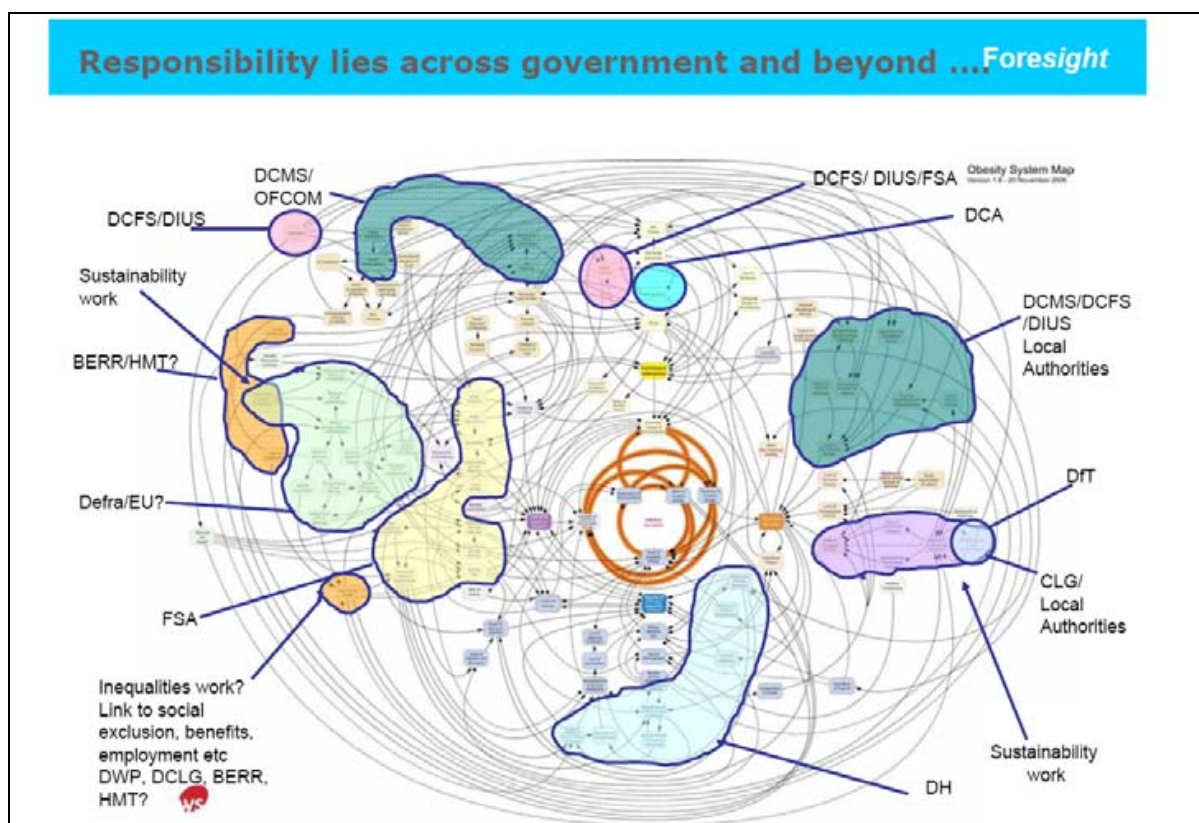
Chapter 7 – Current policy landscape in Scotland

7.1 Background and overview

The Foresight Report, *Tackling Obesities: Future Choices* [2], has been cited a number of times already in this report. Foresight represented the first comprehensive recognition at UK Government level that many of the features of modern living, which are at the heart of the obesity epidemic, are beyond the control of individuals. The authors therefore advocated the need for broad reaching societal wide strategies if the rising trends in the population prevalence of overweight and obesity are to be stabilised and eventually reversed. As described in chapter 1, Foresight made use of a systems mapping approach to conceptualise the biological and social complexity of obesity (see figure 7.1). The overall systems map illustrates the complexity and inter-relationships between the different societal drivers of obesity and that no single dominant factor is clearly identifiable. In consequence, if rising obesity is to be addressed effectively, there is a need for a ‘whole-systems’ approach with a commitment to long-term sustained interventions. Additionally, because many of the key levers of influence lie across and beyond the jurisdiction of single government departments, the problem calls for cross government solutions that also engage other key stakeholders from industry, trade and agriculture.

As is evident from the title, Foresight was written with a future orientation in mind and specifically adopted a notional 50 year time scale. Since many of the possibilities for societal wide interventions are critically dependent on the prevailing political climate and public attitudes, the likelihood of success for a shortlisted series of policy and environmental measures was considered against four quite different future scenarios. The underlying trends and rationale behind each developing scenario are described in detail in one of the Foresight reports accompanying publications, *Visualising the Future: Scenarios to 2050* [156]. The four alternative major sets of drivers for future societal change are

- i. Vocal consumers drive for business to lead change
- ii. Wider social responsibility drives long term preparedness and adaptive behavioural change
- iii. Consensus and collective action sought to deliver flexibility and react to issues of the day
- iv. Short term value maximisation and markets left to balance shifts in resource distribution.

Figure 7.1 Foresight systems map [2]

Seventeen short listed policy options, which were selected as examples of the range and depth of responses that were generated from expert panels, were then imposed on each of the above hypothetical future scenarios. Each intervention was assessed on the degree to which it might impact on three aspects of the obesity epidemic: overall population prevalence of obesity; socioeconomic differences in obesity prevalence and the prevalence of childhood obesity. Five of the shortlisted actions were then deemed to be likely to have the 'greatest average impact' overall on obesity across these three indicator areas:

- increasing walkability/cyclability of the built environment
- targeting health interventions for those at increased risk
- controlling the availability of/exposure to obesogenic foods and drinks
- increasing the responsibility of organisations for the health of their employees
- early life interventions at birth or in infancy.

Crucially, the Foresight Report dismisses any suggestion of a magic bullet, either pharmaceutical or policy led, to redress the obesity epidemic and also rejects options that focus on individual behaviours (except for those that relate to early years intervention). Table 7.1 shows the corresponding government departments where the jurisdiction lies for each of these five intervention areas.

In relation to the five identified priority areas it is reassuring at least to find a high degree of convergence with the initial findings of this report. With the exception of early life interventions, which were outside the brief of the current report, four of the five options would clearly be consistent with the relatively high promise policy and environmental interventions identified in this document. While the 'targeting of those at increased risk' has the least obvious corresponding proposal within the preceding chapters, the higher price sensitivity of those most at risk of obesity to energy rich food purchases, represents a good example of a universally applied measure that targets higher risk groups by default (see section 4.2(ii)).

Table 7.1 Foresight 'highest likely impact options' and the respective government departments/agencies in Scotland and the UK (adapted from Higgins 2010 [157])

Foresight policy recommendations	Holyrood directorates	Westminster departments/government agencies
(i) Increase the 'walkability' and 'cyclability' of the built environment. Introduce health as a significant element in all planning procedures ⁵⁰ .	<ul style="list-style-type: none"> • Transport. • Housing and regeneration. • Built environment. 	<ul style="list-style-type: none"> • Department for Transport. • Communities and local government.
(ii) Targeting health interventions for those at increased risk (dependent on ability to identify these groups and only if reinforced by public health interventions at the population level).	Health directorates including: Chief Medical Officer and Public Health; Healthcare Policy and Strategy; Primary and Community Care; Chief Nursing Officer.	<ul style="list-style-type: none"> • Department of Health.
(iii) Controlling the availability of/ exposure to obesogenic foods and drinks e.g. food labelling standards.	Constitution, Law and Courts; Rural and Environment	<ul style="list-style-type: none"> • DEFRA; Dept for Constitutional Affairs (now Ministry of Justice). • Food Standards Agency • Likely to require EU involvement (see note below⁵¹)
(iv) Increasing the responsibility of organisations for the health of their employees.	Dept of Work and Pensions – though training often delivered/ organised by Scottish agencies.	<ul style="list-style-type: none"> • Department of Work and Pensions.
(iv) Early life interventions at birth or in infancy.	<p>Children, young people and social care.</p> <p>Lifelong learning.</p> <p>Learning.</p>	<ul style="list-style-type: none"> • Department for Children, Schools and Families. • DIUS (now BIS): Business Innovation and Skills. • FSA: Food Standards Agency.

[Shading denotes Scottish Government jurisdiction]

Perhaps the most useful and directly relevant aspect of the Foresight outputs with respect to the current report however, are the characteristics that describe what the authors perceive as an ideal 'portfolio of interventions'. As outlined in chapter 2, the ultimate aim of this current review of evidence around obesity prevention measures is to present a menu of options that would include a broad balance of levels of risk and likely returns, just as would a financial investment portfolio [24]. An ideal portfolio needs to balance the need for short term action against the drive for longer term sustainable change. To achieve this balance, it is best to proceed with a mix of population level and targeted interventions and seek alignment with other policy agendas, recognising synergies and conflicts. The potential for aligning obesity prevention with other public health and political priorities, notably climate change and health inequalities, is described in chapter 8 and discussed extensively in the Foresight Report itself.

⁵⁰ This option is not prioritised but in all bar scenario 4 is deemed to have a positive impact. It complements the walking and cycling proposal.

⁵¹ Food labelling overseen ultimately by EU Directive. <http://www.reading.ac.uk/foodlaw/label.htm>

7.2 Beyond Foresight in the UK and Scotland

i. Nutrition

The hugely challenging agenda set out by Foresight, to develop genuinely cross government, multi-level responses to the obesity epidemic, has given rise to a series of key policy documents from both the UK and the devolved Scottish Government. *Healthy Weight, Healthy Lives: A Cross-Government Strategy* for England⁵², was published in 2008 and dealt with some of the specifics of implementing interventions in the five priority areas. The document had a strong focus on early childhood as well as the prospects for investment in active travel provision and workplace based initiatives. A one year post launch evaluation⁵³ highlighted encouraging progress in a number of areas, particularly in the case study reports of demonstration projects, such as the convenience store healthy food availability programme in north east England (based on a model originally piloted in Scotland, which is described below). The one year follow up report also described several examples of product reformulation by manufacturers and retailers, in which there have been substantial reductions in sugar levels and saturated fat in a number of leading brands. On physical activity measures, early evaluations of cycling demonstration towns (implemented as part of *Healthy Weight, Healthy Lives* priority actions), in England and Wales have been promising (see section 5.4).

Just as with *Healthy Weight, Healthy Lives* the equivalent obesity prevention action plan for Scotland (*Healthy Eating, Active Living*) set out an ambitious life-course based programme of intended actions for 2008 to 2011. Many of the actions outlined in this plan are already underway and have been favourably evaluated. The Schools (Health Promotion and Nutrition) (Scotland) Act 2007⁵⁴ for example, builds on the progress of an earlier schools initiative, *Hungry for Success*, and seeks to improve the standard of school meals as well as increasing their uptake. Local authorities are also encouraged to provide schools with healthy snacks and drinks. For the adult population, the Scottish Grocers Federation's Healthy Living Programme⁵⁵ has demonstrated the capacity of improved 'in store presentation' to increase the purchasing of fruit and vegetables in convenience stores. Although the findings have not yet been subjected to independent peer review, preliminary results have demonstrated significant increases in the sales of fresh fruit and vegetables, as well as increases in self-reported consumption⁵⁶. The apparent success of the approach has led to the adoption of a similar model in England (as part of the Change4Life campaign [see section 6.4] and an additional £1.3 million funding for expansion from the Scottish Government⁵⁷. The additional resources are intended to:

- extend the coverage of the scheme to a wider range of retailers
- expand the range of produce beyond fruit and vegetables to healthier options such wholemeal bread and low fat milk
- create a 'gold standard' for stores already participating in the programme to encourage them to go further in promoting healthier produce.

Early in 2010, the Foods Standards Agency in Scotland issued a policy consultation on more 'upstream' interventions that would be also be consistent with Foresight's third recommendation around restricting the availability of obesogenic foodstuffs⁵⁸. Part of the Agency's Saturated Fat and Energy Intake programme (SFEI), the consultation relates to three specific components, advocating voluntary measures by food manufacturers and retailers to:

- increase accessibility of smaller food portion sizes (see 3.3(ii))
- encourage the promotion and increased uptake of healthier options
- reduce the saturated fat and energy content of popular foods by reformulation measures.

⁵² Healthy Weight, Healthy Lives. Dept of Health (Cross Government Obesity Unit); 2008. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_084024.pdf

⁵³ Healthy Weight, Healthy Lives: One Year On. Dept of Health (Cross Government Obesity Unit); 2009. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_097623.pdf

⁵⁴ Schools (Health Promotion and Nutrition) (Scotland) Act 2007 <http://www.lscotland.org.uk/healthpromotingschools/practitioners/nationalguidance/scottishact2007.asp>

⁵⁵ Scottish Grocers Healthy Living Plan: Evaluation <http://www.communityfoodandhealth.org.uk/fileuploads/sgfhealthylivingevaluationreport-7313.pdf>

⁵⁶ The Healthy Living Programme. Information leaflet. Scottish Grocers Federation; 2007 <http://scottishshop.org.uk/wp-content/uploads/2009/09/Healthy-living-2leaflet.pdf>

⁵⁷ Promoting Healthy Food Choices. News Release. The Scottish Government. <http://www.scotland.gov.uk/News/Releases/2010/02/26170030>

⁵⁸ Draft Recommendations on the Promotion of Lower Fat Products Including Dairy Products, Meat Products and Portion Size Availability. SFEI Programme: Consultation Summary, launched Dec 2009. <http://www.food.gov.uk/multimedia/pdfs/consultation/promolowfatprodssatfatreduct.pdf>

The consultation also goes as far as to stipulate legally binding limits to the fat content of sausages (e.g. recommendation 7 stipulates that by the end of 2012, total fat levels should be reduced by 5% compared to the level in 2008). Such measures have echoes of the maximum fat content limits discussed in section 5.2(i), that were successfully introduced in Ghana. Certain foodstuffs which account for substantial dietary contributions in the UK, also currently have minimum fat thresholds by definition, cheddar cheese and ice cream being the two most notable examples. As a result, the second part of the FSA consultation focuses on the likely implications, including development costs that would be associated with amending the compositional legislation for ice cream and cheddar cheese. Under current food labelling regulations in the UK⁵⁹ for example, products described as ice cream are required to contain at least 5% fat and 2.5% milk protein. In contrast, the equivalent European regulations⁵⁸ have no minimum fat or milk protein content, which has led to calls from manufacturers and suppliers to the UK market for the regulation to be brought into line with the rest of Europe⁶¹. Lower fat ice cream products could then retain their product descriptions and avoid consumer confusion.

Similar 'compositional' considerations currently apply to cheddar cheese where the amount of milk fat expressed as a percentage of the dry cheese is stipulated to be not less than 48%. The realignment of UK regulations with the international CODEX standard for cheddar would allow cheeses with milk fat contents from 22% to 47% to retain the 'cheddar' product label, providing information was included on the modifications made. While these modifications to compositional legislation remain pending, the planning process is obviously at an advanced stage and the FSA's close working with manufacturers, appears to finally be paying off in the form of the development of healthier options for consumers. In an independent review of the Scottish Diet Action Plan in 2006⁶², effective engagement with the food industry was identified as problematic. The close collaboration with manufacturers in the reformulation of compositional standards therefore, can reasonably be regarded as an indicator of progress in what has been a difficult area.

ii. *Physical activity/active travel*

Unlike food legislation, planning is one of the powers devolved from the UK Parliament to the Scottish Government and a new Scottish Planning Policy⁶³ was published early in 2010, which replaced 17 separate planning policies. A total of 37 supplementary Planning Advice Notes (PANs) were also still in place at the beginning of 2010, although some rationalisation of these is likely and ongoing. Official planning policy guidance is critical because it sets the parameters within which decisions are made by local council planning officers and planning committees across the country. Among the few references to health in the new Scottish Planning Policy set up are guideline aspirations around active travel networks and access to green spaces:

'Development plans should promote a pattern of development which reduces the need to travel and encourages active travel and travel by public transport, taking into account the likely availability of public transport in rural areas...' (pp16)

'The planning system has a role in helping to create an environment where physical wellbeing is improved and activity made easier... Access to good quality open spaces can encourage people to be physically active and aid health and wellbeing.' (pp30)

⁵⁹ Food Labelling Regulations, 1996 (UK). http://www.opsi.gov.uk/si/si1996/ukSI_19961499_en_1.htm

⁶⁰ Euroglaces Code of Practice for Edible Ices. <http://euroglaces.eu/en/upload/docs/Edible%20ices%20codes/English%20-%20Code%20for%20Edible%20Ices%202006.pdf>

⁶¹ New Ice Cream Definition Would Boost Reformulation Work. Food Manufacturer.co.uk; March 2010 <http://www.foodmanufacturer.co.uk/Regulation/New-ice-cream-definition-would-boost-reformulation-work>

⁶² Review of the Scottish Diet Action Plan Progress and Impacts 1996–2005 http://www.healthscotland.com/uploads/documents/3158-SDAP_Review_Report_Full.pdf

⁶³ Scottish Planning Policy. The Scottish Government; February 2010 <http://www.scotland.gov.uk/Resource/Doc/300760/0093908.pdf>

The section on transport planning also notes that greenhouse gas emissions need to be reduced to meet climate change targets and one of the means by which this can be achieved is to prioritise other forms of travel (particularly active travel), over motorised vehicles, for example:

‘The aim is for urban areas to be made more attractive and safer for pedestrians and cyclists, including people with mobility difficulties. Cycle routes and, where relevant, cycle parking and storage should be safeguarded and enhanced wherever possible...’ (pp34)

A number of the supplementary PANs also reiterate a commitment to open space provision and active travel considerations. Planning for Transport (PAN 75), for example highlights infrastructure provision for private car alternatives as a key component of sustainable design. PAN 65 (Planning and Open Spaces) describes open space provision as a key criterion of neighbourhood quality and means of encouraging active lifestyles. Other supportive legislation for active travel investment includes climate change targets for the reduction of greenhouse gas emissions⁶⁴ and strategic environmental assessment (SEA)⁶⁵ based on an EU Directive and with which all public sector policies need to be compliant with. While SEA guidance in principle implies that the human health impacts of all statutory policies need to be explicitly considered, the extent to which this is adhered to in practice remains uncertain. This may be due to a lack of consensus on the definition and scope of the term ‘human health impact’, which can sometimes be interpreted quite narrowly around the biomedical/traditional health protection model of health hazards.

Given the potential for a ‘restricted interpretation’ of health commitments outlined in planning legislation above, it is possible to take some measure of reassurance from the publication earlier this year of the Scottish Government’s Cycling Action Plan for Scotland⁶⁶. This plan sets out a number of strong commitments around provision for an improved cycling infrastructure in Scotland. The overall stated objective of the plan is to achieve 10% of all journeys by bike by 2020, through expanding cycle networks across the country and enhancing delivery of cycle training in schools. The plan intends to deliver:

- £2.5 million investment in cycling infrastructure, such as new paths
- A £150,000 trial loan support scheme in 2010–11 to help business improve workplace cycling facilities
- £500,000 to Glasgow City Council for its Connect2 project, allowing cyclists to travel between the city centre, the Clyde riverside promenades, Kelvingrove Park and the west end free of traffic
- £300,000 on child cycle training.

7.3 The route map for obesity prevention in Scotland

While there have been a number of policy responses in Scotland that are consistent with Foresight’s aspirations for tackling obesity, the most directly influenced Scottish Government publication is clearly the *Route Map Towards Healthy Weight* published in March 2010⁶⁷. The document’s overriding ‘mission statement’ sums up the principle conclusion of Foresight:

‘What is required in the long term is transformational change in society to address the threat to individual and collective wellbeing posed by weight gain and obesity. The types of changes we need to make are analogous in terms of scale and complexity, to those required to mitigate and adapt to climate change.’

The Route Map also does not shirk from ambitious objectives, stating the following aspiration at the beginning of chapter 3: ‘for the majority of Scotland’s population to be in the normal weight range (i.e. BMI 18.5 to 25)’. Notably however, there is no timetable given within which this might be achieved. Also like the Foresight Report, the Route Map is not intended to be a prescriptive policy document but instead it ‘aims to set out the future direction of national and local government decision making’. Route Map also effectively goes one stage further than Foresight in that it attempts to translate four of the five Foresight priority areas into specific ideas for policy makers. The four categories of preventative action described in section 6 for instance are clearly recognisable from the Foresight shortlist above:

⁶⁴ The Climate Change (Scotland) Act 2009 http://www.opsi.gov.uk/legislation/scotland/acts2009/pdf/asp_20090012_en.pdf

⁶⁵ The Environmental Assessment (Scotland) Act 2005 http://www.opsi.gov.uk/legislation/scotland/acts2005/pdf/asp_20050015_en.pdf

⁶⁶ Cycling Action Plan for Scotland. Scottish Government; 2010. <http://www.cyclingactionplanforscotland.org/>

⁶⁷ Preventing Overweight and Obesity in Scotland. A Route Map Towards Healthy Weight. Scottish Government; 2010. <http://www.scotland.gov.uk/Publications/2010/02/17140721/19>

- Energy consumption – controlling exposure to, demand for and consumption of excessive quantities of high calorific foods and drinks
- Energy expenditure – increasing opportunities for and uptake of walking, cycling and other physical activity in our daily lives and minimising sedentary behaviour
- Early years – establishing lifelong habits and skills for positive health behaviour through early life interventions
- Working lives – increasing the responsibility of organisations for the health and wellbeing of their employees.

Chapters 4 and 5 of the Route Map respectively summarise the scale of the challenge ahead and the current and ongoing actions that are already planned or underway. The combination of activities currently in place serves to demonstrate that there is no over-reliance on any one particular policy area. Notable successes to date have been the ‘Hungry for Success’ school nutrition campaign, which sought to improve nutritional standards and increase the uptake of school meals by tackling the social stigma around receipt of free meals⁶⁸.

In terms of intended actions, the Route Map describes a fairly extensive portfolio of possible interventions that are being considered, a number of which correspond closely to the action areas that would be well supported by the evidence review that makes up the bulk of this report. Specific ‘energy in’/nutrition related examples include:

- Providing a higher proportion of less energy dense foods as well as smaller portion sizes (through working with manufacturers and retailers) (pp17)
- Reserving the option of statutory measures to improve product formulations and portion sizes in the event of unsatisfactory progress with voluntary measures (pp18)
- Support measures for communicating the ‘energy density’ of products in an easily intelligible way for consumers who may be less health literate (pp19).

On physical activity/‘energy out’ measures, there is a stated undertaking to create environments that make walking and cycling ‘part of everyday life for everyone’, through aspects of existing transport and planning policies, for example:

- Delivering the Cycling Action Plan (described above) with its ambition that 10% of all journeys are made by bike by 2020 (pp20)
- Working with Architecture and Design Scotland to investigate the potential for ‘active travel’ features and facilities in new and refurbished buildings (pp21)
- Reducing community crime and disorder to increase safety and the perception of safety that has been highlighted as an important consideration in travel and recreation choices (see section 3.3 (ii)) (pp21).

These represent only a few selected examples of possible actions that are within the current remit of the Scottish Parliament and that could potentially contribute to a genuinely comprehensive cross-government approach of the sort that has been advocated in the UK Government commissioned Foresight report on obesity. The Route Map gives many other examples of interventions that would be consistent with one or more of the four Foresight-derived priority action areas and that correspond to ‘moderate to high promise’ categories of evidence presented here. It is intended that the current report’s summary of the international evidence base, along with the priority ranking exercise described in chapter 8, will help inform the eventual balanced portfolio of proposed actions that would have the best prospect of making a sustainable impact on the rising prevalence of overweight and obesity in Scotland.

⁶⁸ Hungry for Success – A Whole School Approach to School Meals in Scotland: Final Report of the Expert Panel on School Meals. November 2002. <http://www.scotland.gov.uk/Publications/2003/02/16273/17566>

Chapter 8 – Prioritising the way forward

8.1 The portfolio matrix and evidence informed policy

The portfolio matrix for categorising obesity prevention measures, introduced in section 2.6, presented a framework for decision making that should in principle help policy makers develop a balanced programme of intervention proposals across all four ANGELO domains (i.e. physical, economic, legislative and socio-cultural). Although originally developed as a generic health promotion template, the portfolio approach is ideally suited to obesity because of its diverse and rapidly evolving evidence base, together with the capacity of the matrix framework to accommodate scientific uncertainty. The portfolio approach also provides a rationale for taking a relatively broad and inclusive approach to evidence finding and appraisal that is highly appropriate for complex embedded public health problems such as obesity. As was also highlighted in chapter 2, traditional appraisal criteria for published evidence tend to focus on aspects of study design which can be very limiting outside of an experimental type setting. For this reason, several commentators have highlighted the need to consider an evidence-informed approach to obesity prevention as opposed to an evidence-based approach and a recent US Institute of Medicine publication on decision making in obesity prevention sets out a detailed iterative process for working with a developing evidence base (The LEAD Framework: Kumanyika *et al* 2010 [158]). The IOM framework emphasises the value of learning from ongoing policies and practices and retaining the flexibility to incorporate improvements based on any insights gained.

Regarding the use of the portfolio matrix to categorise interventions highlighted in previous chapters, the following assessment criteria for ‘level of scientific certainty’ and ‘potential population impact’ (tables 8.1(a) and 8.1(b)), were arrived at using the combined guidance of several published templates for translating evidence about complex public health interventions into practice [24, 158, 159, 160]. A key principle in relation to this type of appraisal is the need to be conscious of the limitations of conventional study design criteria, alongside the important contribution that observational and qualitative work can bring, particularly with regard to transferability and context.

Table 8.1(a) Portfolio criteria for evaluating level of certainty

Level of certainty	Supporting level of evidence
High	Robust credible research evidence (e.g.: using conventional appraisal criteria based on the quality of studies), combined with convincing evidence of transferability to a UK or Scottish setting (most likely to be derived from observational or qualitative studies).
Moderate	Consistent associations corroborated by different types of study design along with established plausibility and low risk of biased interpretation.
Low	Inconsistent reports and / or questionable objectivity based on the type of information source or poor study quality / high risk of bias

Table 8.1(b) Portfolio criteria for evaluating likely population impact

Likely impact	Supporting level of evidence
High	Evidence of effectiveness at population level in UK or comparable country with “effect size” ≥ 0.05 (at least 5% change in a primary outcome linked to healthy weight).
Moderate	Effectiveness demonstrated in community/institutional settings and likely to be transferable to the UK / Scotland.
Low	Inconsistent or contradictory evidence of population effectiveness e.g. confined to small numbers/subgroups or where specific pre-conditions apply.

Using these guidance notes, it is possible to allocate a matrix position for any proposed intervention on the basis of the information available. In the following example the economic and the legislative domains of the ANGELO framework have been combined in one table. For convenience, the colour coded template from chapter 2 is also reproduced below. In this way it is possible to assemble a comprehensive portfolio of interventions in the manner advocated by the Foresight team [2] and by the WHO [1].

Table 2.4 Portfolio matrix for categorising potential interventions (*reproduced as previous*)

Certainty of effectiveness*	Potential population impact#		
	Low	Moderate	High
High	Promising	Very promising	Most promising
Moderate	Less promising	Promising	Very promising
Low	Least promising	Less promising	Promising

*Certainty of effectiveness – judged by the quality of the evidence, the strength of the programme logic as well as the sensitivity and uncertainty parameters in the modelling of the population impact (adapted from Swinburn *et al*, 2005).

#Potential population impact takes into account intervention efficacy (impact under ideal conditions), combined with ‘real-world’ reach and uptake and generally reflects effectiveness at the societal level, weighted for relative baseline ‘burden of attributable illness’.

Tables 8.2(a) to 8.2(c) show the matrix placing for many of the interventions covered in this report on the basis of the above guidance tables and information from their respective source references. It is important to note that because there is an element of subjectivity associated with each of these matrix allocations and the evidence base is continuously being developed, the respective positions are also likely to be subject to change over time.

Table 8.2(a) Portfolio matrix for categorising physical environment interventions

Certainty of effectiveness*	Potential population impact [#]		
	Low	Moderate	High
High	Point of decision prompts (3.5i)	Multi-component workplace programmes (3.3iii)	<i>As yet no convincing measures score 'High' on both criteria</i>
Moderate	Workplace building design (3.5i)	Active travel incentives/facilities (3.4ii)	Built environment modifications to enhance safety
Low	Proximity to healthier food choices (3.2)	Portion size availability restrictions / wider choices (3.3ii)	Private car restricted areas (3.4ii)

Table 8.2(b) Portfolio matrix for categorising economic and legislative interventions

Certainty of effectiveness*	Potential population impact [#]		
	Low	Moderate	High
High	Local price incentives for healthier diet (4.3)	Trade restrictions/tariffs (5.2i)	Sugared beverage tax (4.2)
Moderate	Financial incentives for physical activity (4.5)	Mandatory Food labeling (eg: traffic light labels) (5.2ii)	Agricultural frameworks/ CAP Reform (5.2iii)
Low	Self-regulation by food industry (5.3)	Workplace Food Policies (4.3)	Area-wide cycling route investment (5.4)

Table 8.2(c) Portfolio matrix for categorising sociocultural interventions

Certainty of effectiveness*	Potential population impact [#]		
	Low	Moderate	High
High	Comprehensive workplace active travel programmes (e.g. including on site facilities and assisted purchase schemes) (6.5iii)		Campaigns backed with supportive regulation (5.3)
Moderate	Large scale public activity events (6.4)	Food advert restrictions (6.2)	Mass media activity campaigns (6.4)
Low	Primary care exercise referral (weight maintenance) (6.5i)	Personal travel plans (6.5ii)	Targeted education campaigns for food awareness & cooking skills (6.3)

Selecting several examples therefore as a guide to interpretation, within the table for physical environment (8.2(a)), there were no identifiable interventions which fulfilled the highest level of promise by scoring highly on both potential impact and level of certainty. Workplace building design alterations (such as ‘stair skip’ (3.5ii)) and Point of Decision Prompts (PODPs (3.5i)), are supported by a high level of certainty from the published evidence, but their likely population impact, at least in the UK, would be low to moderate. The state of the evidence identified around economic interventions does suggest that a tax on sugared beverages can be afforded the highest level of promise by having a strong level of certainty across multiple settings and a likely high population impact, as a regional structural measure (due to high consumption levels and relatively high price elasticity). Purely information based campaigns in isolation score low on both level of certainty and likely impact, since they are generally not well targeted and the evaluation of their effectiveness, other than recall and problematic self-reporting, is notoriously difficult.

8.2 Portfolio implementation

While the portfolio matrix as it stands offers a useful means of categorising potential interventions, it does not incorporate what is arguably the most important stage in the process of new policy development, namely that of planning for implementation. As described in the final section of their introductory paper [24], Swinburn and colleagues suggest that moving from ‘could do’ to ‘should do’ brings in an entirely new set of considerations for stakeholders and decision makers. Although largely qualitative in nature, these judgements nevertheless need to be articulated and transparent, since they are likely to materially influence the balance of proposals in any intervention portfolio. Their five additional proposed ‘filter criteria’ (see table 8.3) of: practicality, sustainability, effects on equity, potential side effects and acceptability to stakeholders, encompass the final stages of the decision process. In this adapted table, the term ‘practicality’ has been used instead of ‘feasibility’ (as in original table) because of its greater specificity of meaning. It was felt that the term ‘feasibility’ could equally be applied to any of the five filter criteria, each of which could conceivably impact on the feasibility of a given intervention.

Table 8.3 Suggested filter criteria for stakeholder judgements on implementation

Filter criteria	Description
Practicality	The ease of implementation considering such factors as: the availability of a trained workforce; the strength of the organisations, networks, systems and leadership involved; existing pilot or demonstration programmes.
Sustainability	The durability of the intervention considering such factors as: the degree of environmental or structural change; the level of policy support; the likelihood of behaviours, practices, attitudes, etc becoming normalised; the level of ongoing funding support needed.
Effects on equity	The likelihood that the intervention will affect the inequalities in the distribution of obesity in relation to: socioeconomic status; ethnicity; locality; gender.
Potential side effects	The potential for the intervention to result in positive or negative side effects such as on: other health consequences; stigmatization; the environment; social capital; traffic congestion; household costs; other economic consequences.
Acceptability to stakeholders	The degree of acceptance of the intervention by the various stakeholders including: parents and carers; teachers; health care professionals; the general community; policy makers; the private sector; government and other third party funders.

(Source: Adapted from Swinburn, Gill and Kumanyika, 2005 [24])

Crucially, these additional filters could serve as a useful basis for constructive discussions around the merits and feasibility of individual proposals. The same approach has been successfully employed to combine technical/research outputs with contextual/real world considerations, in the fields of mental health and cancer prevention [24]. They also represent an important conceptual link with the ANGELO framework, through the explicit acknowledgement that no complex public health intervention can be implemented without consideration of its wider political, economic, environmental and social context. The highly context dependent nature of these considerations however, means that the transferability of even 'well evidenced' interventions that have not yet been tested in a Scotland/UK setting could well be limited. In practice therefore, assigning a definitive placing to intervention proposals within the grid becomes a relatively complex undertaking. The fact that such a task is no longer merely a research based exercise, underlines a need for the widest possible stakeholder involvement in working through the five filter criteria in table 8.3, in order to arrive at a properly informed assessment of implementation feasibility. Such a broad 'stakeholder group' would ideally include frontline practitioners and representatives of the target population, as well as policy makers, with input from public health professionals and government. Provided with a shortlist of relatively high promise interventions, discussion groups could then be asked to allocate 'feasibility scores' for each of the five criteria in table 8.3, using a 5 point likert scale as follows:

1. Not at all feasible in proposed setting
2. Significant doubts about feasibility
3. Feasible and should be possible to implement in proposed setting
4. Feasible and easy to implement in proposed setting
5. Highly feasible with no practical problems in most settings.

Having discussed and scored each of the five criteria, an overall average 'ease of implementation' score' could be derived for each proposed intervention. Interventions with a relatively robust evidence base and a clear favourable consensus on ease of implementation would represent strong prospects for investment. There will inevitably be some proposals which, despite meeting an acceptable effectiveness threshold, are simply not feasible (e.g. in Scotland) at the present time. In order to further illustrate the process, tables 8.4a and 8.4b, outline hypothetical stakeholder comments against each of the filter criteria for two interventions:

- Transport infrastructure investment programme to improve active travel safety (an activity related physical environment measure: Section 3.4)
- A statutorily imposed limit on portion sizes in restaurants (e.g. by weight or total calorie content: Section 3.3) [Note: not described in review as a legislative intervention in section 5, since dealt with only as an 'availability' issue and no studies were identified that made use of statutory limits].

Table 8.4(a) Hypothetical filter criteria results for transport infrastructure investment

Filter criteria	Description	Score [#]
Practicality	The very substantial capital investment required at a time of constrained government spending is likely to reduce feasibility in the absence of a proactive fiscal stimulus package.	2
Sustainability	Critical shifts required across government and in public consciousness. Transport investment remains heavily biased in favour of private car transport and minor 'active travel' projects risk being unsustainable if they are relatively isolated. In the absence of a comprehensive approach therefore, sustainability limited.	2
Effects on equity	Under current road conditions, unless actual safety (and perceptions of safety) could be improved, achieving wider take up will be problematic and those with the potential to benefit the most are not likely to participate. Genuine improvements in safety will help address this issue and have been shown to increase participation (even in US).	3
Potential side effects	Adverse side effects likely to be minimal. Better traffic segregation benefits all road users. Large reductions in revenue returns from fuel duty revenue also unlikely since most substituted journeys are likely to be short ones and more than offset by reductions in healthcare costs (accidents and premature cardiovascular mortality).	5
Acceptability to stakeholders	Experience from New York (section 3.4) and London (reduced traffic by means of congestion charge) suggests that initial levels of resistance are likely to decline over time as people realise the benefits of improvements.	4

#Score: 1 to 5 scale, where 5 is the most favourable for 'ease of implementation' and 1 the least favourable.

Table 8.4(b) Hypothetical filter criteria results for restaurant portion size limit

Filter criteria	Description	Score [#]
Practicality	While legally binding limits would obviously be the best way of ensuring compliance (in the light of voluntary schemes being largely ineffective, demonstrated by trans fats story in New York, section 5.3), their practical feasibility would not be straightforward. Considerable difficulty in enforcement also likely to be compounded by caterers finding 'creative' solutions e.g. two starters for the price of one etc.	2
Sustainability	Sustainability could be undermined by practical difficulties in enforcement highlighted above and high levels of stakeholder (and customer) resistance.	2
Effects on equity	There is a possibility that the more compliant restaurateurs might find their profitability affected in the short term.	3
Potential side effects	Unless carefully thought through, the potential for this measure to have an adverse effect on the more enlightened commercial caterers cannot be discounted. This is the very group who are already likely to be attempting to provide food that is at the more nutritious end of the spectrum.	3
Acceptability to stakeholders	Difficulty foreseeable in an environment in which 'value for money' where food is concerned is still interpreted in terms of quantity. Unlikely to find favour therefore with restaurateurs or with their customers. There are indications however that the public would appreciate a greater range of choice in portion size (not the same as compulsory reductions in portion size of course).	3

[#]Score: 1 to 5 scale, where 5 is the most favourable for 'ease of implementation' and 1 the least favourable.

Without any claim to be comprehensive, Tables 8.4(a) and 8.4(b) at least serve to illustrate some of the complexities involved in assessing the ease of implementation across Swinburn and colleagues' five criteria. The degree of subjectivity and scope for influence by individual values, priorities and prejudices is also readily apparent and underlines the challenge that the managed consensus process will involve. If managed well, however, the result should be a well balanced portfolio of realistic options with clear indications on how straightforward each proposal would be to implement alongside its likely chances of leading to a desirable outcome in Scotland at the present time.

8.3 Obesity as a 'complex adaptive system'

As a means of addressing the high level of complexity and the results of applying multiple additional filter criteria outlined in table 8.1, the modern obesity epidemic has itself been described as exhibiting all the features of a 'complex adaptive system' (CAS). A CAS is defined as being 'composed of many heterogeneous pieces interacting with each other in subtle or non-linear ways that strongly influence the overall behaviour of the system'. The three characteristics of the obesity epidemic which mimic a CAS are [14]:

- A vast range in the levels of scale that is relevant (e.g. ranging from molecular/genetic to societal and global)
- A wide diversity of 'actors' ranging from small local retail outlets to multinational corporations and world trade organisations
- The multiplicity of mechanisms and processes at work (from neuronal reward pathways for satiety to the 'spreading' of behaviours in social networks, and influences from the built environment, as well as economic factors).

Furthermore, even where mechanisms of effect are clear (e.g. the apparent association between access to green space and propensity for physical exercise, leading to effects on BMI as outlined in the Portland/Oregon studies reviewed in chapter 3), the linkages and feedback between these mechanisms are not necessarily well studied or well understood. Hammond [14] eloquently describes five general features of a CAS which could have important implications for anti-obesity interventions, which are (i) individuality of 'actors' (which can be people, larger social units, governments etc); (ii) 'actor' heterogeneity at each level (e.g. in goals, rules, adaptive repertoire, and constraints); (iii) complex interdependence; (iv) emergence: CASs are often characterised by emergent unexpected phenomena (e.g. patterns of collective behaviour that form in the system as a whole); and (v) tipping: CASs can also exhibit the phenomenon of 'tipping' in which intrinsic non-linearity can mean that small changes result in massively disproportionate system overhaul, or recalibration to a new 'equilibrium'.

Considering obesity as a complex adaptive system helps to underline two basic principles about planning interventions, these being:

- that single component interventions by themselves are unlikely to succeed
- it is important not to overlook the cumulative effects of a number of small changes.

Single component interventions are unlikely to have a measurable impact, particularly on weight outcomes, firstly because of the almost universally small effect sizes seen throughout this report, and secondly, from the tendency of complex systems to preserve 'equilibrium' (individuals for example may compensate for more physical activity by increasing their food intake [161]). With regard to 'small changes', a joint task force report led by the American Society for Nutrition, advocated a societal approach to tackling obesity based on incremental small changes in both diet and physical activity. First proposed by Hill and colleagues [20], the 'small changes' approach is based on the principle that small changes in habit are likely to be more sustainable than major lifestyle changes. It also arises from the

observation that weight gain throughout the adult life-course is mediated by very marginal imbalances in energy intake and expenditure. The special task force report cites a number of examples where small change interventions have proven to be successful in changing weight outcomes and in altering environmental determinants. The examples cover several interventions already discussed in detail in this report, including reductions in portion sizes (section 3.3), replacing helpings of sugar sweetened beverages with sugar free alternatives (section 4.2) and simple point of decision prompts (PODPs) for increasing stair use (section 3.5).

A multiple small changes programme therefore adheres to both of the above principles in dealing with a complex adaptive system. The objectives of such a programme would be first to stabilise obesity rates by reducing or halting the rise in prevalence before focusing in turn on reducing the absolute prevalence of obesity. The basic underlying logic is simply that if the obesity epidemic has been caused by the gradual concurrence of many different drivers at every scale in the modern world being 'ratcheted' in one direction [16, 26], then it should be possible to unpick the process by multiple small ratchets in the opposite direction. Given the problems that can arise from trying to engage different stakeholders who can be far apart in their immediate objectives, Hills's report for the US Nutrition Task Force envisages that the small changes approach could provide a common focus for all stakeholders to both coordinate their actions, whilst making their own distinct contribution [20]. The fact that by definition the changes do not need to be massive, should also help mitigate resistance from vested interests, which can be a major stumbling block as illustrated by the efforts around trade tariffs and food labelling in section 5.2. In the most optimistic scenario outlined in the report, the author suggests that the effect of multiple coordinated small changes operating in the right direction, might be sufficient to push modern societies to a new 'tipping point' where the possibility of reversing obesity trends could finally be a real prospect. This would of course only be realistic when a majority of the subtle obesogenic policy and environmental drivers have switched in a sufficiently complimentary and convergent manner that they effectively re-inforce each other and bring about a seismic shift in the overall direction of travel.

8.4 Combining public health and economic perspectives

While the health benefits from tackling obesity should make a sufficient case in their own right to persuade policy makers that prevention measures would make worthwhile investments, it should also be borne in mind that all governments continually face a wide variety of demands and proposals that call upon their attention and resources at any one time. With chapter 4 of this report already devoted to the economic environment and almost every potential intervention having some cost implications from some stakeholder's perspective, it is clear that the economic case for obesity prevention must be *set alongside* the public health rationale, especially under the conditions times of constrained public expenditure, which both the governments of Scotland⁶⁷ and the UK are likely to be operating under for the foreseeable future. One highly articulate account of drawing together public health and economic perspectives, was a recent discursive review by Bleich and Sturm on policy solutions to increase physical activity in the US [162]. In classical economics for instance, neither health compromising behaviours nor their adverse outcomes like obesity, are themselves a justification for government intervention. Similarly, any health risk by itself is not viewed by economics as a problem, unless it has arisen as a consequence of market failure to optimise the allocation of resources. Generally speaking, there are three broad types of situation where markets fail to optimally allocate resources: public goods (once they are freely available, nobody has an incentive to pay for them), externalities (side effects arising from production or consumption of a good, but not include in the price) and information asymmetry (where one party is not fully aware of the likely benefits or risks).

⁶⁷ Scotland' Public Finances: Preparing for the Future. Audit Scotland; November 2009. http://www.audit-scotland.gov.uk/docs/central/2009/nr_091105_scottish_public_finances.pdf

Market failures arising from public goods and externalities are more applicable to physical activity, while those arising from information imbalance are more likely to be related to food [162]. The economic case for intervention is usually apparent from an examination of where market failure arises. Examples covered in this report include:

- The supplementary tax on sugared beverages in chapter 4 (to counter the information imbalance for consumers regarding the risk)
- Measures to increase pedestrian safety to reduce the externalities of driving (section 3.4)
- Increased availability of safe recreation space (increasing the supply of public goods) (section 3.4).

In this way, instances of market failure apply to almost all environmental drivers for obesity, since people are often not fully informed about long term risks or alternatives, and the obesogenic behaviour becomes effectively the line of least resistance. The economic case therefore, is usually complementary to traditional public health evidence of effectiveness, particularly when actual choices and behaviours are more closely aligned with an individual's own preferred outcomes (e.g. good health and healthy weight).

8.5 Historical public health parallels

The search for historical parallels can often be a useful source of fresh insights into current problems that have similarities with the 'insurmountable' issues of the past. Victorian public health measures (i.e. hygiene) for example, although based on an incomplete biological understanding of the infectious aetiology of much prevalent disease at that time, amounted to a combination of substantial infrastructural investments to develop good sanitation, as well as large scale information campaigns to change personal habits, even including proscribing of some of those habits (e.g. spitting in the street) [163]. This was a time before modern public health diverged into what Rayner labels as its two constituent 'ruling orthodoxies', namely the biomedical model versus the healthy choices model. Many now consider this 'split' to have been a detrimental step and there has been a strong case made for a return to a more 'ecological' or whole system perspective, which genuinely reflects the degree of complexity associated with multi-factorial public health issues like obesity [163]. In response, there is now a variety of published ecological/whole systems models dealing specifically with the obesogenic environment, the most comprehensive of which is that produced as part of the UK Government's commissioned Foresight Report discussed in chapter 7.

Above all, ecological models emphasise the complicated interplay between different drivers across all of the four major domains of the ANGELO framework. They may also help to facilitate a return to the practical solution orientated measures that characterised the Victorian approach. In spite of an incomplete understanding of contemporary common diseases and the massive scale of the challenge, they devoted very significant efforts and resources towards combating what was in many respects a 'toxic environment' with regard to infectious pathogens. The one advantage that they did have when compared to the current obesity epidemic, was widespread public concern driven by the rapidity with which cholera, typhoid and similar epidemics developed, combined with a strong enough political will to implement structural interventions. The political pressure, in contrast, for governments to act on obesity prevention is largely professionally led [164], even though mainstream media maintains a relatively high profile for the crisis. Victorian infectious disease outbreaks exerted a visibly lethal and rapid effect on mortality, as opposed to the 'slow burn' 25-year time frame of excess mortality attributable to obesity. Ironically, for both modern chronic obesity-related disease and the Victorian infectious disease epidemics, no sector of society was immune. A more appropriate public health analogy therefore, is probably tobacco smoking, where increasingly compelling scientific evidence prompted a professionally led campaign that eventually changed public attitudes enough to support measures, such as bans on public area smoking which would have seemed draconian, even ten years previously. Although tobacco is certainly different, in so far as there is no such thing as a 'healthy smoke', and involuntary exposure (i.e. forced consumption) of obesogenic food is rare, there are strong similarities in the current attitude and defences of the food industry to calls for structural controls [165, 166].









8.6 Integration with other political and health priorities

Advocates for public health action on obesity prevention can certainly take some encouragement from the ‘tobacco journey’, in that professionally led attempts to alter the culture around smoking eventually delivered on their promise, in the form of effective taxes and a greatly diminished social acceptability of smoking. Making the case, however, that some dietary constituents are intrinsically bad, or that certain seemingly harmless leisure time pursuits (such as intensive TV watching) should be avoided or minimised, is much less likely to be gratefully received and acted upon. Taking account of such considerations, combined with an established reluctance of the general public to be told what to do by health services and government, it is hardly surprising that calls for large scale actions to tackle obesity drivers are largely restricted to health and other professionals, who are continually confronted with the consequences [164]. In lobbying terms from a politician’s point of view, this makes for a relatively small constituency and one that is unlikely to receive a great deal of attention in the face of so many other pressing priorities and responsibilities. Given the very broad scope of obesity drivers and their high degree of ‘shared pathology’ or common underlying causes (e.g. over-consumption) with several other major public health problems, there is plenty of scope for combining actions to mitigate obesity with other high profile campaigns in the political/public arena. The most notable of these two targets are health inequalities [167] and climate change [168].

i. Health inequalities

For a wide variety of reasons, sections of the population who experience relatively higher levels of socioeconomic deprivation are not as well equipped to deal with the negative pressures on health status exerted by many obesity drivers. From English population data at least, the steep increases in child obesity through the early 2000s (which were also seen in Scotland), were clearly more marked in children from lower income families. Interestingly in one particularly well powered study based on two national survey sources [169], there was a stronger association for income than for social class itself, leading the authors to speculate on the likely importance of budgetary constraints as a barrier to a healthy household diet. A major international systematic review published in 1999, based purely on longitudinal studies, also found a strong and consistent association between childhood socioeconomic status and increased obesity in adulthood [170]. The relative absence of any social gradient for adult obesity in Scotland (except for the marginally increased risk for women in lower social classes and a slight inverse risk for men [see section 2.3]), may suggest that the reach of the epidemic is so universal that all groups are similarly affected by adulthood. Although the epidemiology of obesity in Scotland (chapter 2) is not profoundly socially patterned, it only requires a cursory consideration of the four ANGELO domains to begin to appreciate the increased challenges that are likely to arise in association with social deprivation. Table 8.3 summarises these likely additional barriers and, as with previous illustrative tables in this chapter, it does not set out to be exhaustive. Mitigation strategies that have already been discussed are also included for each example. Although the society wide prevalence of obesity may render a socially targeted prevention programme ineffective, there are strong socioeconomic exacerbating factors across all four ANGELO intervention domains that could conceivably be addressed by well evidenced interventions discussed previously in this report.

Table 8.5 Obesogenic drivers associated with deprivation by ANGELO framework domain

DOMAIN	Physical	Economic	Legislative	Sociocultural
Factor/driver	High neighbourhood disorder.	Tendency to opt for lowest cost per calorie.	Lower social groups less able to campaign for their interests.	Immediate gratification often a coping strategy.
Leads to...				
Effect of deprivation re obesity	Reduced opportunity/ inclination for activity.	Increased consumption of energy dense foods.	Tendency towards making do with poor options/local facilities.	Longer term consequences of behaviour not considered.
Counteract with...				
Potential mitigation	Improved safe/ green space provision.	Subsidised healthier foods; restrict bulk promotions of HFHS foods.	Facilitated community development / activity events.	Improvements to circumstances = Reduced comfort seeking behaviours
Relevant section (s)	3.4	4.2; 5.2	3.4; 6.4	6.5
References	[66, 81, 171]	[103, 104] and [172]	[66], [143, 146]	[1, 148, 173]

Social inequality and poverty therefore do not fulfil the definition criteria for classical epidemiological risk factors in the case of obesity and overweight. In complex systems thinking discussed above, they are risk regulators in the broadest sense and can most usefully be viewed as dynamic components governing interactions with the obesogenic environment, influencing obesity related behaviours at the personal and societal level [15]. Since these interactions can best be moderated by structural and policy interventions discussed in this report, the major means of ameliorating their impact should be external and not rely on personal choices in the social groups where this is most restricted.

ii. Climate change

The now overwhelming scientific consensus, that mean global temperature rises of 1.4 °C to 5.8 °C⁶⁸ can be expected by the turn of the next century, have focused minds on the likely implications of this increase for human health [168]. All governments are now well aware of the need to be seen to be acting responsibly in relation to climate change mitigation and there have been encouraging signs from the Obama administration in the US, although it is unlikely to be plain sailing⁶⁹. Since health consequences are most frequently discussed in terms of population shifts of infectious disease vectors, and climate mediated changes to the food supply, direct links to the obesity pandemic are not often self evident. Also, in contrast to advocacy for obesity prevention, climate change activism is very well established, as well as being mainstream and worldwide. It is fortunate therefore, in one sense, that many of the actions needed to deal with the threat of climate change have a substantial and readily apparent overlap with measures needed to tackle obesity [164, 174]. From the need to walk and cycle more, and reduce dependence on private motorised transport, all the way up to formulating new international trade agreements for a more sustainable and ecologically sound food supply, there are major crossovers between the objectives

⁶⁸ Climate Change 2007: The Scientific Basis. Intergovernmental Panel on Climate Change IPCC: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/spmssp-projections-of.htm

⁶⁹ Obama's Climate-Change Bill Stymied by Bipartisan Quarrel. The Independent; 26 April 2010. <http://www.independent.co.uk/news/world/americas/obamas-climatechange-bill-stymied-by-bipartisan-quarrel-1954231.html>

of both major agendas. Interventions which promote healthy eating or physical activity, but which are enacted for other reasons, could be considered ‘stealth interventions’.

Environmental sustainability, like the obesity epidemic, has all the features of a complex systems problem, although public appreciation of complexity in the case of the latter remains relatively limited [172]. Since many of the societal changes for both problems have substantial overlaps, it should be feasible to dovetail obesity prevention efforts into the environmental sustainability agenda, where there is already widespread public engagement. Huang elegantly describes a six-phase strategy for converging efforts in these the two areas [15, 174]:

- i. Framing obesity as a complex systems issue in both the scientific and public spheres
- ii. Emphasising cross level and cross disciplinary hypotheses at the outset of research
- iii. Investing in the testing and evaluation of upstream interventions
- iv. Increasing the capacity to conduct multi-level research and policy translation, by building coalitions and training a new generation of multilevel scientists and practitioners
- v. Developing and applying systems-science methodologies to the obesity problem
- vi. Cultivating a global perspective.

The call to increase capacity for research in multi-level interventions, is a reflection on the current absence of any real evidence base in the effective use of this type of modelling for obesity or public health problems in general. Forward looking documents, such as the Foresight Report and the Scottish Government’s recently published Route Map for Obesity Prevention⁷⁰ have clearly grasped the need for a whole systems approach. It is hoped that this document, in combination with the ambitious scope of the Route Map, can be the beginning of a genuinely balanced programme of interventions that are able to target *all* the relevant domains and major drivers at the core of the obesity epidemic.

8.7 Recommendations for next steps

Based upon the discussion frameworks and additional broader ranging considerations set out in this chapter, it is clear that any managed consensus process needs to be able to draw upon a broad and wide ranging mix of expertise and experience to derive a practicable portfolio of potential policy interventions to tackle obesity. In order for any such discussions to be maximally productive, the panel or groups would benefit from having ready access to:

- A summary portfolio matrix with each recommendation categorised by ANGELO domain and its respective level of evidence (following the format outlined for complex public health interventions by SIGN/NICE)
- An estimate of the potential population impact (e.g. in Scotland) of each proposed intervention
- Brief guidance notes for each stakeholder to assign feasibility scores according to the ‘third axis’ filter criteria of practicality, sustainability, effects on equity, potential side effects and acceptability to stakeholders.

8.8 Limitations of this review

Since there are very few aspects of modern living that are not related in some way to rising obesity prevalence, it is virtually impossible to present a comprehensive list of contributory factors or potential targets for intervention. While the published scientific literature around obesity is also vast and voluminous, the difficulties associated with investigating obesity mean that progress is at different stages in different areas and the quality of studies can be highly variable. This review sets out to categorise environmental and policy interventions in such a way that takes account of their relative strength of evidence and potential population impact. It does so by making use of two previously validated

⁷⁰ Preventing Overweight and Obesity in Scotland: A Route Map Towards Healthy Weight. The Scottish Government; 2010. <http://openscotland.net/Publications/2010/02/17140721/0>

frameworks, namely the ANGELO system (analysis grid for environments linked to obesity) and the portfolio matrix for complex public health interventions. No classification system will ever provide a perfect fit for a multi-dimensional problem such as obesity and there are inevitable areas of overlap and uncertainty within the approach as presented in this review. The capacity of the system to accommodate uncertainty and revisions where appropriate however, means that it can provide the raw material for building a comprehensive intervention strategy based on the current state of the evidence base. The critical phase of any set of proposed interventions is of course 'real-world' implementation and judgements around practicality, sustainability, effects on equity, potential side effects and the acceptability to stakeholders can only be made with the input from a broad range of relevant experience and expertise. The template scoring system for these more subjective discussions does not set out to be a definitive quantitative tool, but rather serves as a focus for deciding on the implementation feasibility of any specified intervention.

8.9 Overall conclusion

For the reasons given in the above chapter it would be inappropriate to attempt to describe a definitive list of policy options that should be implemented in order to tackle rising obesity prevalence in Scotland. Drawing on the full report however, a number of generalisations can clearly be derived that could be used to inform the next stage in the process:

1. Policy options to tackle the obesogenic environment are characterised by an enormous diversity of approaches and draw upon a highly variable evidence base from observational associations to randomised trials
2. Conventional categories of evidence for health-care interventions, based on hierarchical classifications of study design (with randomised trials being the gold standard), are often insufficient to accommodate complex embedded public health issues like obesity, where questions of transferability and context are critical components to the feasibility of any intervention
3. The availability of validated policy frameworks such as ANGELO and Swinburn and colleagues' portfolio matrix, offers decision makers a systematic means of summarising policy and environmental options alongside a decision making framework that takes account of scientific uncertainty
4. A 'portfolio approach' also helps promote the concept that any serious attempt to tackle obesity will need to be based on a multi-component approach that can address the powerful social, economic and environmental drivers which sustain the epidemic. The success of multi-component workplace interventions provides encouraging evidence that concerted programmes of action can result in real benefits
5. In spite of the enormity of the challenge that obesity presents, it shares substantial commonality with other major public health problems of our time such as climate change and health and social inequalities. Implementing evidence informed solutions to rising obesity is therefore a question of integrating the task closely with the other substantial challenges facing modern society
6. Ultimately therefore, the decisions about how best to prioritise policy intervention options to tackle obesity will need to be carefully appraised for their feasibility at a local and regional level alongside their capacity to achieve 'win-wins' for societies other major challenges. The potential for high level gains should have a strong appeal for stakeholders at the national level as well as enhancing sustainability with minimal adverse impacts on target populations.

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